5 Mechanical

1937 ACHIEVEMENT ISSUE

AUTOMOTIVE INDUSTRIES

LAND — AIR — WATER

OCTOBER 23, 1937

VANDERBILT UNIVERSITY
LIBRARY

IN KEEPING WITH MODERN REQUIREMENTS FOR TIRE SERVICE AND SAFETY

Schrader Tire Valves have all of these Essential Features

Safety!

The Airtight Valve Cap prevents road dust and dirt from reaching the valve mechanism.

Economy!

The Replaceable Valve (Core) may be easily removed, permitting inspection or renewal.

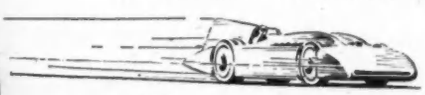
Strength!

The Metal Housing holds the valve mechanism securely in place and protects it against damage.

Durability!

The Rubber Cover and Base are one piece of tough, live rubber, cured permanently to metal housing and tube.

300 MILES AN HOUR ON TIRES EQUIPPED WITH STANDARD SCHRADER TIRE VALVES!*



* Sir Malcolm Campbell, Bonneville Salt Flats, Utah, September 3, 1935.

Schrader Tire Valves are engineered to meet every requirement of modern tire manufacture and to provide a maximum of safety under the many and extreme conditions encountered in everyday service.

More than one hundred million Schrader-type Tire Valves are in daily use.

Service!

Schrader Tire Valves and parts are sold by more than 100,000 dealers.

The name Schrader on the valve cap and base of a tire valve is your guarantee of safety and long service.

A. SCHRADER'S SON BROOKLYN, NEW YORK

Division of Scovill Manufacturing Company, Inc.

MAKERS OF PNEUMATIC VALVES SINCE 1844

Schrader
REG. U.S. PAT. OFF.
TIRE VALVES

"The Standard Lubrication Engineer was here today...

we 'stepped up' output on the gear shapers"

Such conversation takes place somewhere almost every day. Not always about gear cutting. It may be honing, grinding, or the lubrication of other equipment, but "the Standard Lubrication Engineer had been there... and suggested a saving."

That is only natural. Standard Lubrication Engineers are trained, equipped and placed at your service for the purpose of spotting opportunities to reduce lubrication costs in your plant. Their knowledge of lubricants enables them to make these savings *safely*—without sacrificing lubricating quality or obtaining low cost lubrication at the expense of high maintenance. Their combined experience covers every phase of industrial lubrication.

You have been overlooking a real opportunity to get helpful, money-saving suggestions on lubrication if you have failed to investigate this service. It's free. Call your local Standard Oil (Indiana) office today and ask for the Standard Lubrication Engineer.

ACME CUTTING OILS HAVE OVERCOME MANY CUTTING OIL PROBLEMS

Acme Cutting Oils were developed to meet certain definite demands for a more effective, economical cutting lubricant, and at the same time overcome valid objections to available lubricants. As a result you will find four distinct advantages in using Acme Cutting Oils.

1. They contain ample compounding to insure good finish and longer tool life under present high speed production demands.
2. They will not corrode machines, work or tools.
3. They will not turn rancid or develop an odor in use.
4. They will not cause skin irritations or infections.

To provide the most economical application Acme Cutting Oil is made in four grades, covering a wide range of operations, from high speed automatics to severe slow speed turning on drilling.

Let a Standard Lubrication Engineer specify the correct grade for your work.

©1937

THE RIGHT LUBRICANT • PROPERLY APPLIED • TO REDUCE COSTS

STANDARD OIL COMPANY (INDIANA)

LUBRICATION ENGINEERING

AUTOMOTIVE INDUSTRIES
AUTOMOBILE

Reg. U. S. Pat. Off.
Published Weekly

Volume 77 Number 17

JULIAN CHASE, Directing Editor
HERBERT HOSKING, Editor
P. M. HELDT, Engineering Editor JAMES U. STEINFIRST, News Editor
JOS. GESCHELIN, Detroit Technical Editor GEOFFREY GRIER, Art Editor
HAROLD E. GRONSETH, Detroit News Editor MARCUS AINSWORTH, Statistician
JEROME H. FARRIS, Ass't Editor L. W. MOFFETT, Washington Editor
H. E. BLANK, JR., Ass't Editor JAMES G. ELLIS, Washington Editor

1937 ACHIEVEMENT ISSUE

CONTENTS

News of the Industry 533
"As Shows Claim the Spotlight" 543
What Designers Have Done in Passenger Car Development for 1938 . . . . . *By P. M. Heldt* 556
Mechanical Specifications of 1938 Passenger Cars 559
Just Among Ourselves 573
Mechanical Ingenuity Boosts 1938 Production to Higher Utility . . . . . *By Joseph Geschelin* 574
National Metal Exposition and Metal Congress . 576
Present Realities in the Tourist Trailer Industry . . . . . *By Philip H. Smith* 578
Refinements Stressed in 1938 Plymouth . . . 535-589
Hypoid Rear Axle on Longer Wheelbase for New Lincoln-Zephyrs 536-596
Chevrolet Features "Tiptoe-matic" Clutch . 537-594
Chrysler Lines Are Restyled 538-598
Two Graham Lines Fitted to 1938 Modes . . 539-583
Pontiac Enters 1938 Season with Sixes and Eights 540-586
1938 Cadillac Line Features New V-16 . . . 541-590
DeSoto Improved in Chassis and Body 542-584
New Clutch for Chevrolet '38 Trucks 593
Business in Brief 618
Automotive Abstracts 619
Tools of Tomorrow 621
Calendar of Coming Events 627
Advertisers' Index 220

Copyright 1937 by Chilton Company (Inc.)

C. A. MUSSELMAN, Pres.; J. S. HILDRETH, Vice-Pres. and Manager, Automotive Division; G. C. BUZBY, Vice-Pres.

OFFICES

Philadelphia—Chestnut & 56th Sts., Phone Sherwood 1424
New York—239 W. 39th St., Phone Pennsylvania 6-1100. Chicago—Room 916, London Guarantee & Accident Bldg., Phone Franklin 9494. Detroit—1015 Stephenson Bldg., Phone Madison 2090. Cleveland—609 Guardian Bldg., Phone Main 6860. Washington—1061 National Press Bldg., Phone District 6877, San Francisco—444 Market St., Room 305, Phone Garfield 6788. Long Beach, Cal.—1595 Pacific Ave., Phone Long Beach 613-238.
Cable Address .....Autoland, Philadelphia

SUBSCRIPTION RATES: United States, United States Possessions, and all countries in the Postal Union, $1.00 per year; Canada and Foreign, $2.00 per year. Single Copies this issue, 25c.

Member of the Audit Bureau of Circulations
Member Associated Business Papers, Inc.

Entered as second-class matter Oct. 1, 1925, at the post office at Philadelphia, Pa., under the Act of March 3, 1879.
Automotive Industries—The Automobile is a consolidation of the Automobile (monthly) and the Motor Review (weekly), May, 1902; Dealer and Repairman (monthly), October, 1903, the Automobile Magazine (monthly), July, 1907, and the Horseless Age (weekly), founded in 1895, May, 1918.

Owned and Published by

CHILTON COMPANY
(Incorporated)
Executive Offices
Chestnut and 56th Streets, Philadelphia, Pa., U. S. A.

Officers and Directors

C. A. MUSSELMAN, *President*
FRITZ J. FRANK, *Executive Vice-President*
FREDERIC C. STEVENS, JOSEPH S. HILDRETH, GEORGE H. GRIFFITHS, EVERIT B. TERHUNE, ERNEST C. HASTINGS, *Vice-Presidents;* WILLIAM A. BARBER, *Treasurer;* JOHN BLAIR MOFFETT, *Secretary;* JOHN H. VANDEVENTER, JULIAN CHASE, THOMAS L. KANE, CHARLES S. BAUR, G. CARROLL BUZBY, P. M. FAHRENDORF.

(Advertisement)

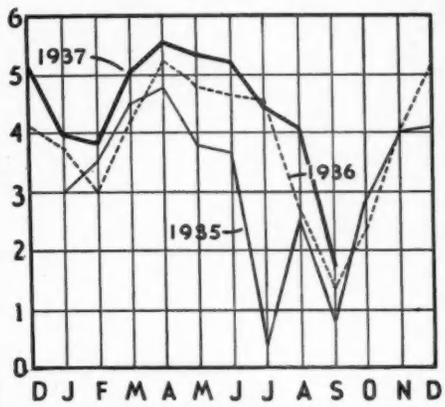
AUTOMOTIVE PRODUCTION*

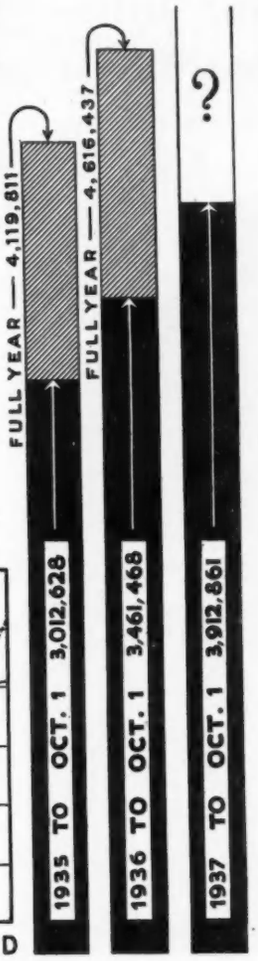
Passenger Cars and Trucks —U.S. and Canada

Bar charts at the right represent total production to Oct. 1st of year indicated.

Numbers at left of monthly graph below show production in 100,000's.

*From Department of Commerce Report and Automobile Manufacturers' Ass'n.





Ideas in Zinc

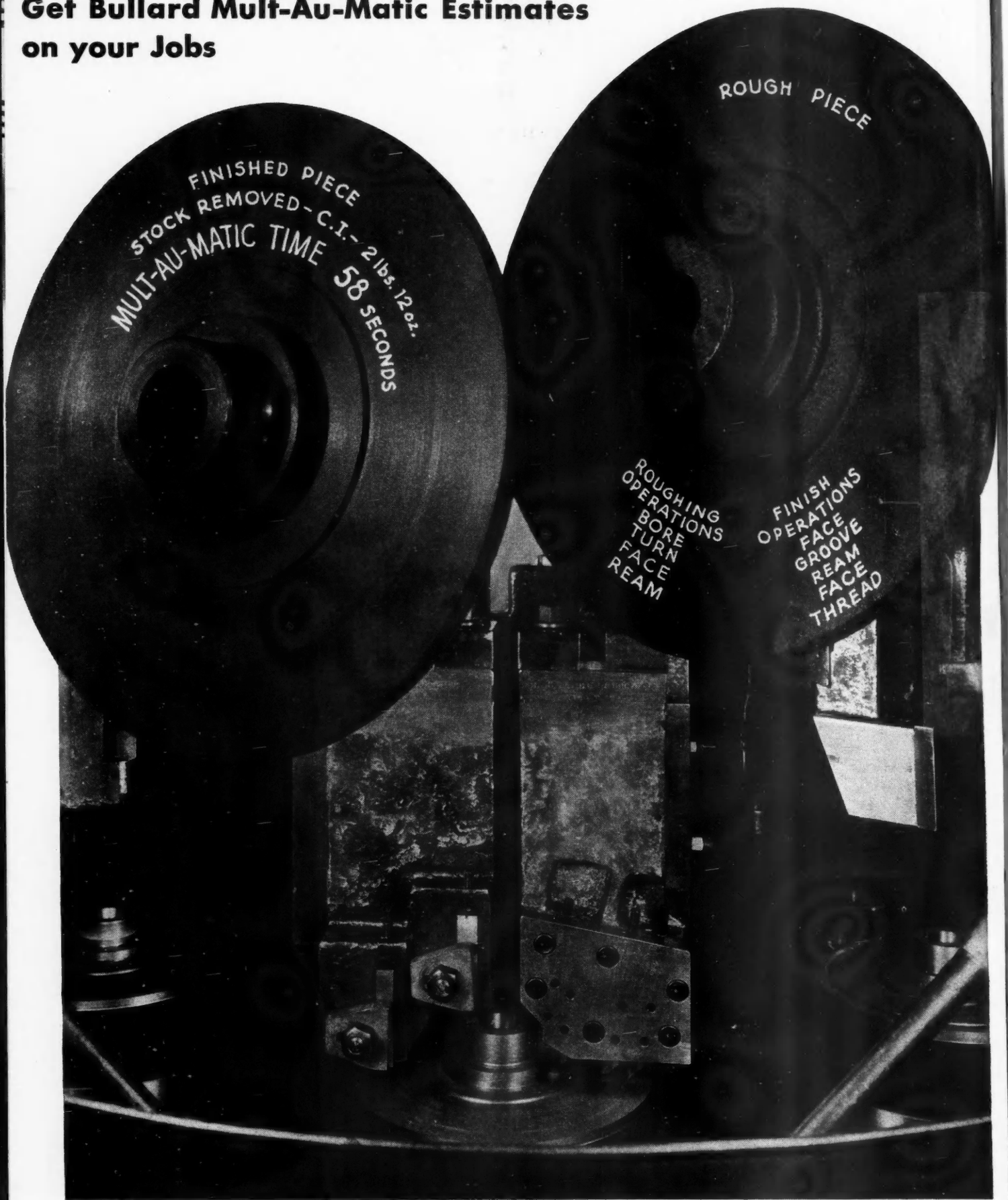
Judging by the previews of the '38 cars, radiator grilles are still a tremendously important appearance feature. It is of more than passing interest to note that die cast grilles not only have held their own, but have added several important users from the roster of the big names in the industry.

One of the chief reasons for the increased use of this type of grille on next year's models has been dealer demand. The radiator grille, by creating the greatest single note of distinction on the car, naturally means much to the dealer in his sales talks to the prospect. With the new grilles, die cast in zinc alloy, the dealer can point out their sturdy, solid construction as being typical of the construction to be found throughout the entire car. This factor gives him an important edge for competitive selling against those cars still equipped with the previously favored type of grille.

The design engineers in the industry are to be applauded for the fine job they have done with these grilles. They have pointed the way to even greater possibilities for the use of the high strength, stable Zamak Alloys based on Horse Head Special Zinc of 99.99+ per cent purity. The New Jersey Zinc Company, 160 Front Street, New York City.

Idea No. 5

If Others can Profit . . . *So can You.*
Get Bullard Mult-Au-Matic Estimates on your Jobs



THE BULLARD COMPANY
BRIDGEPORT, CONNECTICUT

Published Weekly
Founded 1895

AUTOMOTIVE INDUSTRIES

October 23, 1937
Vol. 77, No. 17

Production, Sales Trending Up

Volume Improves as More New Cars Reach the Field but True Comparison Must Wait New York Show Results, Is View

With more 1938 automobiles on the market and a better supply of the new cars in the field, the retail sales curve of the industry is again pointing upward. The seasonal dip which marked the clean-up of old lines probably reached its low point early this month, although delivery reports of some companies for the first ten days of October showed they already had made the turn. The second ten-day period should show substantial improvement with a decided lift expected in the final ten days of the month when nearly all lines will be on the market and sales will enjoy the stimulus of the New York show.

It is too early to make any worthwhile comparisons with a year ago because of the varying dates of new car announcements, but in two instances where field stocks of new models were comparable with those a year ago, retail deliveries were running higher. Not until figures are in for the reporting period following the New York show will it be possible to detect whether there is any important slowing down in automobile sales as a result of the impairment of confidence and buying power caused by the drastic stock market shake-out. Sales executives have come around to the view that some slowing down can be expected affecting primarily cars in the upper price strata.

Meanwhile, production plans for the immediate future have not been disturbed. Output is climbing daily with a majority of plants nearing full scale operations. The factory employment index of the Detroit Board of Commerce advanced more than 10 points during the first half of October to 120.8 which compares with 99.6 on Oct. 15, 1936. Ford assemblies got under way on a small scale at the Rouge plant during the past week. Some of the branch plants are expected to swing into operation before the end of the month but quantity production will not be reached until November.

Steel companies expect a considerable volume of business from the automobile companies in the next week or ten days. A leading Detroit steel producer reported a noticeable improvement in the last few days and said that there had been no trimming down of order schedules already placed. The delay in steel buying by motor companies was explained by the substantial carry-over from the 1937 model year, now being worked off. The unfavorable comparison with a year ago is due to stocks on hand, and to the fact that there is absolutely no forward buying this year. Last year there were two powerful incentives to buy ahead. One was the strike threat on both sides and the other was rising prices. With next quarter's prices already announced, and with more stable labor conditions, it is expected that steel buying will be only for current needs. The uncertainty of the retail market for automobiles, of course, is also a factor. For the present, steel consumption by the automobile industry is running heavier than at the corresponding time last year.

—H. E. G.

Prices Announced

New 1938 Car Schedules Show Higher Levels

Another group of 1938 car prices, just announced, shows continuance of the uptrend which began in August. Certain of the increases, however, were smaller than was expected in some quarters in the industry.

Chevrolet, announcing new prices coincidentally with display of the 1938 line all over the country, stated that the new price list includes a standard group of accessories such as front and rear bumpers, spare tire and tube, radiator ornament, and, on the deluxe

(Turn to page 624, please)

PAUL G. HOFFMAN
President of Studebaker and subject of Republican conversations

Talk of Hoffman

As the Possible Republican Nominee Reaches Open

Rumors, which are confirmed by a clipping from the Springfield (Mass.) *Daily News*, have been in circulation since last summer, we are told. They concern talk of the possibility of Paul G. Hoffman, Studebaker's head, as a Republican candidate for the presidency. On being shown the clipping by a friend Mr. Hoffman said: "Oh . . . I saw the damned thing." According to other reports which have reached us from scattered points, the talk is spreading.

The clipping is from a syndicated column of comment on personalities in the news of the day written by Lemuel F. Parton. It appeared in several large cities during the early part of the present month. The facsimile which is

(Turn to page 628, please)

Achievement...

THIS entire issue of AUTOMOTIVE INDUSTRIES is devoted to the achievements in automobile design for 1938 and to the men who made them possible. We would like to call your attention to these highlights: our own pictures and brief biographies of the various car company engineers on pages 543 to 555; a summary of the developments in car design for 1938 by P. M. Heldt, on page 556; descriptions and 13 pages of mechanical details of eight new lines; and specifications of the 1938 product on pages 560 to 572.

Preliminary Facts and Figures of the Automobile Industry

for the Year Ended September, 1937

From the Automobile Manufacturers Association

New Automotive Records

Total passenger car registration
Total motor truck registration
Total motor bus registration
World motor vehicle registration
Retail sales of trucks in United States
Aggregate taxes paid by motor vehicle users
Gasoline consumption
Bus production

Production and Value	
Car and truck factory sales, U. S. and Canada	5,110,000
Passenger cars	4,182,000
Motor trucks	928,000
Percentage increase over 1936	12%
Wholesale value of cars, U. S. and Canada	$2,336,300,000
Wholesale value of trucks, U. S. and Canada	$ 540,200,000
Wholesale value of cars and trucks combined	$2,876,500,000
Wholesale value of parts and accessories for replacement, and service equipment	$1,075,000,000
Wholesale value of rubber tires for replacement	$353,000,000
Motor vehicles, accessories, service equipment and replacements of parts and tires	$4,304,500,000
Registration	
Motor vehicles registered in U. S.	29,000,000
Motor cars	24,600,000
Motor trucks	4,400,000
World registration of motor vehicles	41,750,000
Per cent of World's automobiles in U. S.	70%
Taxes	
Total motor vehicle user taxes	$1,565,000,000
Gasoline taxes, federal, state and municipal	$975,000,000
Percentage motor user taxes to all taxes from all sources, federal, state and local	15%
Employment	
Employment, manufacturing autos, bodies & parts	515,000
Weekly payroll, wages	$16,000,000
Automobile's Relation to Other Business	
Automotive industry is the largest purchaser of gasoline, rubber, steel, malleable iron, mohair, lubricating oil, plate glass, nickel and lead	
Number of carloads of automotive freight shipped over railroads	3,710,000
Rubber used in automobile industry	75%
Steel used by automobile industry	18%
Lumber, hardwood, used by automobile industry	6%
Copper used by automobile industry	17%
Lead used by automobile industry	36%
Zinc used by automobile industry	11%
Tin used by automobile industry	14%
Aluminum used by automobile industry	12%
Nickel used by automobile industry	28%
Gasoline consumption by motor industry	89%
Gasoline used by motor vehicles (gallons)	19,300,000,000
Gasoline consumption by motor vehicles, retail value including taxes	$3,780,000,000
Lubricants used by motor vehicles (gallons)	404,000,000
Lubricants, percent used by motor vehicles	40%
Motor Trucks and Buses	
Motor trucks in use	4,400,000
Total special motor truck taxes	$418,000,000
Fleets of more than 5 trucks, number of operators	29,750
Number of truck drivers	3,150,000
Communities served exclusively by trucks	48,500
Motor buses produced	18,000
Motor buses in use	127,000
Foreign Sales	
Number of American motor vehicles sold outside United States (U. S. exports and output in Canadian plants owned by U. S. firms)	620,000
Per cent of production sold outside U. S.	12%
Value of motor vehicles, parts and tires exported from U. S. and Canada	$361,700,000
Motor Vehicle Retail Business	
Total car and truck dealers	46,753
Total repair shops	98,529
Total retail outlets, duplications eliminated	102,342
Wholesalers	5,913
Retail gasoline outlets	380,000

UAW Speeds GM Talks

Ask Knudsen to Join Parley; Position Detailed

Efforts are being made by the United Automobile Workers to speed negotiations with General Motors Corp. on the revision of their contract. To this end a meeting of the bargaining committee chairmen representing GM plants was held in Detroit, Oct. 17 and 18. It was decided to ask W. S. Knudsen, president of General Motors, to sit in on the conferences negotiating changes in the contract, union officials feeling that his presence would make for better progress.

One of the most important points discussed at the meeting of bargaining committee chairmen was a more efficient means of disposing of the large number of local grievances which have been a source of considerable unrest. The union blames the grievance pro-

(Turn to page 616, please)

MEN OF THE INDUSTRY

L. B. F. RAYCROFT of the Electric Storage Battery Co. has been re-elected president of the National Battery Manufacturers Association for a third term. Other officers are:
R. T. PIERSON, first vice-president, USL Battery Corp;
E. T. FOOTE, second vice-president, Globe-Union, Inc.;
L. N. TALKES, secretary, Cleveland Storage Battery Co.; and
L. A. DOUGHTY, treasurer, Carlile & Doughty, Inc. Directors are:
F. C. KROEGER, Delco-Remy Corp.;
S. W. ROLPH, Willard Storage Battery Co.;
W. F. PRICE, Price Battery Corp.;
R. D. MOWRY, Universal Battery Co.;
A. H. DAGGETT, National Battery Co.;
B. F. MORRIS, Thomas A. Edison, Inc.

PHILIP E. BLISS, president of the Warner and Swasey Co., has been appointed a trustee of the Case School of Applied Science at Cleveland.

FRANK HARRISON, assistant works manager, International Harvester Co., has been elected a vice-president of the National Safety Council, in charge of the industrial safety division.

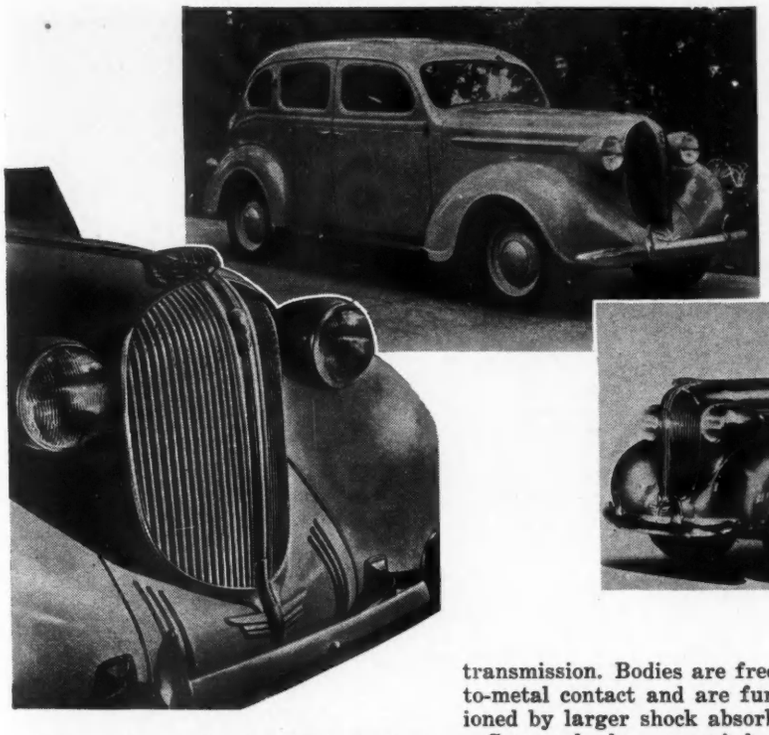
DR. PAUL H. SCHWEITZER, professor of engineering, Pennsylvania State College, has been appointed a Lieutenant Commander, U. S. Naval Reserve.

WALTER A. OLEN, president and general manager, Four Wheel Drive Auto Co., will be a principal speaker at the banquet for exhibitors and truckers attending the Motor Truck Show at Newark, N. J., Nov. 6-12.

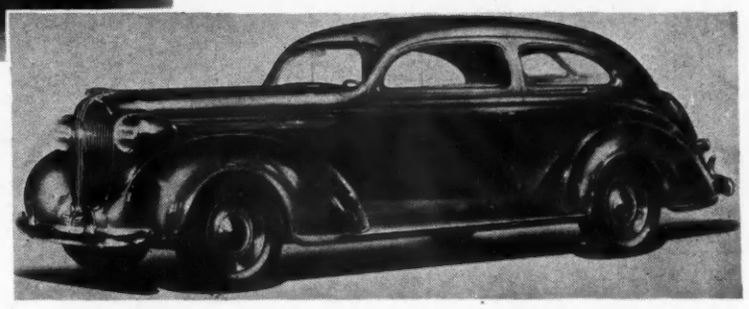
WALTER O. BRIGGS, chairman of the board, Briggs Mfg. Co., on Oct. 15 formally presented a gift of athletic equipment to Michigan State Normal College.

A. C. CHAMBERS has been appointed sales manager of the brake and power brake division of Bendix Products Corp. and **R. C. ALLAN** has been appointed sales manager of the carburetor division, it was announced by Frank B. Willis, vice-president in charge of sales. Both men will make their headquarters in Detroit.

J. R. TRANTER is now general manager of the Kold Hold Mfg. Co. as well as president of the company. He succeeds **W. G. FARNSWORTH** as general manager. Mr. Farnsworth continues as vice-president and a director. Mr. Tranter purchased the controlling interest of R. E. Olds in the company last June and is taking active charge of the business.



PLYMOUTH TENTH anniversary series is announced. Front end styling is new and includes a die cast radiator grille, and deeper fenders joined by a sheet metal apron. The hood is longer, the windshield higher for better driver-vision. A faster steering gear ratio is a new mechanical feature with safety as the objective. Other controls are easier to operate.



Plymouth cars for 1938 include three "business" and eight "de luxe" body styles, all on a 112-in. wheelbase and all powered with an 82-hp., L-head engine. These are the company's tenth anniversary models and have been restyled, reappointed, and changed in the direction of improving riding and handling ease.

There is a new radiator grille, more nearly upright than before, and a longer hood with side panels ordinarily fixed but removable. Front fenders sweep 1½ inches lower than on previous models and flow into a new, rounded apron under the grille with trim and decoration of chromium. The windshield has been enlarged and is said to provide 12 per cent more vision. Color is used to accent the exterior front and rear.

The instrument panel is new and is finished in brown. Controls are sunk or recessed flush for safety and dials are face-lighted instead of edge-lighted. New defrosting vents are provided on each side of the one-piece windshield glass.

Steering has been made faster with a new ratio of 14.6 against the last year's 16.4 and its action has been improved through the use of roller bearings at the upper end of the kingpin. A light-pull hand brake is provided and is mounted under the center of the instrument panel, acting on a separate brake band.

A study of driving conditions resulted in the use of larger headlights, each reflector now having 11 sq. in. more area. Lights and other electrical demands are served by an enlarged and ventilated generator.

Care has been given to silencing the ride. Plymouth uses five different kinds of insulating materials other than rubber, while floor pans have been stiffened and more deeply ribbed to avoid sound transmission. Bodies are free of metal-to-metal contact and are further cushioned by larger shock absorbers.

Spare wheels are carried upright flat against the inside panel of the luggage compartment, a change said to increase the amount of space in either compartment or built-in trunk. More leg room is achieved in the rear passenger compartment by recessing the footrest into the back of the front seat, while front seat cushions have been redesigned to employ more springs in supporting the weight of the passengers. Mechanical details will be found on page 589 of this issue.

Chevrolet Truck Program

Chevrolet division of General Motors Corp. has set a commercial car quota for the 1938 season of 225,000 units out of the domestic sales objective of 1,200,000 cars and trucks. This would compare with 190,000 out of 1,020,000 for 1937. The division has also set a used car quota for the coming season of 2,250,000 vehicles.

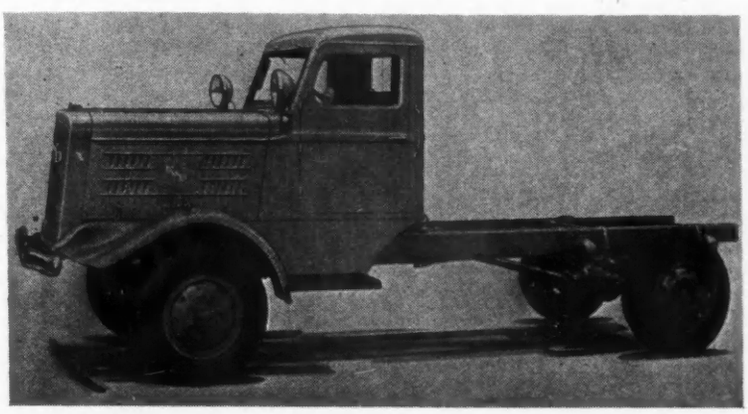
Sloan and Knudsen

Discuss Outlook; Price Rise Does not Cover All Costs

General Motors Corp. has still not offset the full increase in labor and materials costs through price increases, according to a statement by Alfred P. Sloan, Jr., chairman of the board. Mr. Sloan pointed out that the higher revenues from the sale of cars are distributed among workers in the automobile and material-supplying industries.

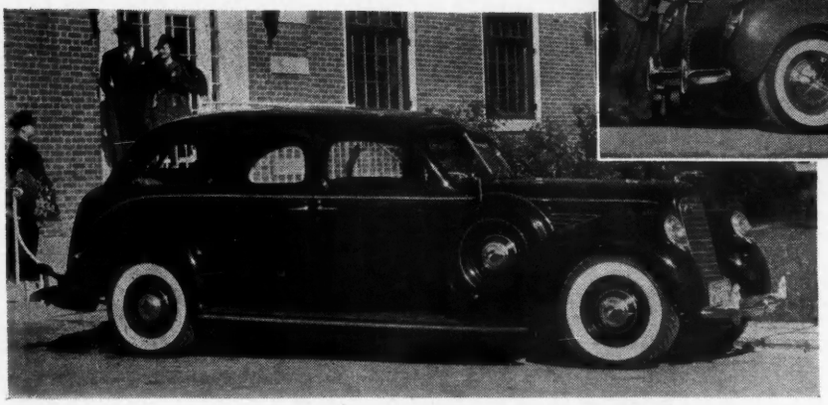
There are more new cars in dealers' hands at this time than was the case a year ago, he remarked, commenting on the effort of the industry to supply work the year round. "Unless there are unforeseen developments," he said, "winter production will reflect this effort."

William S. Knudsen, president of the company, said that GM has tried by expansion to prevent a recurrence of car shortages. He said that a production total of 5,000,000 cars and trucks is practically assured for 1937 and forecast another "banner year" for the industry in the United States in 1938.



FWD MODEL produced by the Four Wheel Drive Auto Co. and designed especially for highway maintenance work. The transfer case is built so that a clearance of 23 in. under the driving mechanism permits installation of an underbody scraper or other equipment. Rated capacity is two tons. Standard wheelbase is 156 in.

Lincoln, Lincoln-Zephyr



STYLING is emphasized in the Lincoln - Zephyr for 1938, shown above. Featured is an entirely new treatment of the radiator grille which is in two parts and is placed low at the front. Wheelbase is now 125 in. Gear shift lever is now off the driving compartment floor. At the left is a new Lincoln sedan which features detail improvements in body and chassis.

Restyled front and rear is the new series of Lincoln-Zephyr cars, which includes convertible models for the first time. In addition to the changes in the appearance of the cars, a number of alterations have been made in the mechanical arrangements. Wheelbase is 125 in., an increase of three inches.

Front end treatment now features the placement of the radiator openings low down and extenting from the insides of the front fenders to the center. Excepting for the side louvers, the hood therefore runs forward from the windshield down over the front end. Headlights are placed high and forward in the fenders with the lenses contoured to match the fender curve. Fenders themselves are drawn rearward, while at the rear end the design has been cleaned up to eliminate projections.

In the front compartment there is a new instrument panel which includes a closed grille extending down to the top of the transmission housing to conceal radio and heater installations.

To enlarge and clear the front compartment, engine and transmission have been moved forward and the latter component turned on its side to reduce overall height. The gear shifting lever is now out of the middle of the compartment and is mounted on the driver's side of the center assembly which houses radio and heater. Gear shifting is made easier and quieter by changes in the transmission. A further step in the floor-clearing program is the adoption of hypoid rear end gears to reduce floor tunnel height.

Improvements in the steering system are said to improve handling and parking ease, this facilitated also by the cable-controlled, fully-energizing braking arrangements. Riding qualities are bettered by the longer wheelbase, which makes possible a spring base of 136 in.

Spare wheel and supporting frame are located in the luggage compartment and can be swung down and out of the way to give access to the luggage space itself.

Acme

AT PARIS was exhibited the new Lincoln-Zephyr with what in the background appears to be the new Ford for 1938. The marked changes in styling of both cars are clearly shown. Fender-mounted headlights appear on both lines and on the Lincoln, shown above at the left. Designers have cleaned up the exteriors of the cars.

Twenty-one body types are available on the Lincoln chassis, principally on a 145-in. wheelbase and powered with the V-12 engine. There are several close-coupled sports models which are built on a 136-in. wheelbase. Bodies are provided by Lincoln, Brunn, Judkins, LeBaron and Willoughby.

Particular attention is paid to assuring handling ease. Clutch, brakes and steering gear require but little effort to operate. The braking system has a vacuum booster and the transmission is all-silent with improved synchronizing characteristics.

Mechanical details will be found on page 596 of this issue.

Chevrolet Dealers Meet

Chevrolet's National Dealer Planning and National Dealer Used Car Committees met in Detroit last week to discuss the company's production and sales policies for the fall market. Seventeen dealers, representing the nine Chevrolet regions in the United States, took part in the sessions. W. E. Holler, Chevrolet general sales manager, addressed the representatives of Chevrolet's 9600 dealers at a joint session of both committees on Tuesday, outlining the market projection for the coming year.

Japan Short of Labor

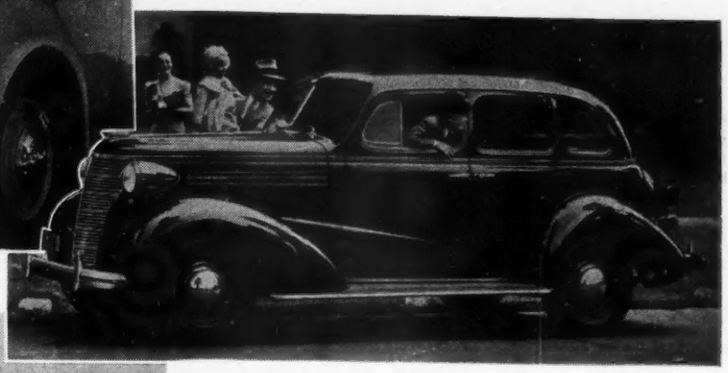
Automotive Manufacturers Lack Skilled Workers

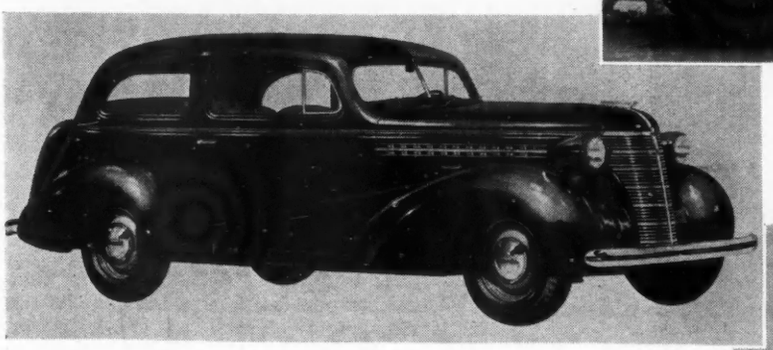
Many new Japanese automotive manufacturers have been compelled by the current shortage of skilled labor to delay actually starting operations. With the exception of a few major enterprises which have established their own training shops in accordance with recent legislation, Japan's automotive industry is at a point where the solution of the technical labor problem is of the utmost importance.

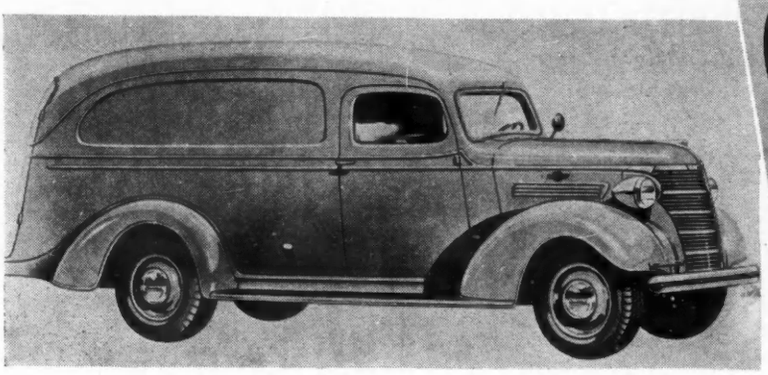
The Niigata Iron Works, one of Japan's "big five" tool makers and the pioneer in automotive Diesel manufacture (incidentally one of the enterprises under training shop legislation) will speed up its plans for the manufacture of automobile Diesels on a larger scale, taking advantage of the deadlock.

The Mitsubishi Jukogyo K.K. (Mitsubishi Heavy Industries, Ltd.), has

(Turn to page 204 in the advertising section, please)







CHEVROLET passenger car bodies are two inches wider for 1938, a change made possible by widening the rear tread. The frontal appearance of the line is changed by use of a horizontal-barred, two-section grille and new hood louvres. Somewhat similar style treatment is accorded the commercial line. Major mechanical change is the adoption of an entirely new "diaphragm-spring" clutch. Upper right illustration is a Master Deluxe; center left is a Master model. Lower left is a half-ton panel truck on a 112-in. wheelbase.

Chevrolet passenger car bodies for 1938 are two inches wider at the rear than before, measuring 47 in. at the rear seats, a change made possible by widening the rear tread to 59 in. Front ends are restyled and now comprise a two-section radiator grille which is almost upright in profile and has horizontal bars.

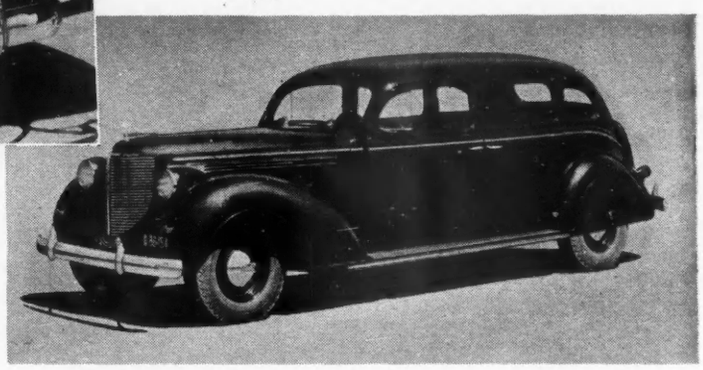
Both the Master Deluxe and Master series embody one major mechanical change in the form of a new diaphragm-spring clutch which is said to add considerably to operating ease and smoothness. Engine changes are in the nature of refinements, although the use of the new clutch permits a lighter flywheel. There is also a new and higher-capacity electrical system with a generator having a 28-amp. average maximum output. Starting arrangements have been changed to provide a starter pedal which is so connected with the throttle as to feed gasoline at the start. It is not connected with the accelerator.

Quieter operation is said to be assured by a new means of mounting the rear springs on the axle. Metal-to-metal contact is eliminated and no servicing is said to be required. Master Deluxe models retain the enclosed type of independent front wheel suspension; Master models use an I-beam front axle and semi-elliptic springs.

In the car interior, a new instrument panel with illuminated ignition lock, a steering wheel adjustable to the spoke position preferred by the driver, a new handbrake and soft-roll front seat backs are among the improvements provided. Interior trim is light tan, relieved by colored control knobs and some use of chromium and stainless steel. Luggage-compartment room is increased by mounting the spare wheel upright in a well at the right front corner. The compartments are insulated and protected against moisture.

Chevrolet's truck line for 1938 comprises a number of models on six different chassis. The major mechanical change is the adoption in the commercial line of the new type diaphragm clutch.

Appearance has been improved with a new styling similar to that of the passenger cars, and special attention has been paid to ease of removal of the various units for servicing. All front bumpers are now regular production equipment. Cab refinements are directed at increasing driver comfort and safety, while bodies are better insulated to protect the load. Mechanical details of passenger and commercial lines will be found on pages 593 and 594 of this issue.



NEW STYLING marks the front end appearance of both the Chrysler Royal, shown at the left, and the Chrysler Imperial, shown below. Brightly finished chromium bars running horizontally from the center of the radiator grilles, fender-mounted headlights and deeper windshields are three outstanding characteristics of the cars. A number of improvements have been made in the bodies to add to the comfort and safety of passengers.

Chryslers Are Announced

Two new series of passenger cars carrying the Chrysler nameplate, the Chrysler Royal and the Chrysler Imperial, are announced for 1938. Front-end styling of both is new, featuring horizontal bar chromium radiator grilles narrowing at the bottom, "pleated" sheet metal below the grilles and between the front fenders, and headlights mounted just inside the crown of the fender. Front fenders are slightly ridged at the crown.

The Chrysler Royal wheelbase has been increased three inches to 119 in., while the Imperial is four inches longer at 125 in., and the Custom Imperial is four inches longer at 144 in.

Hoods are long, hinged at the center, and have bolted-on side panels which serve as radiator braces and are removable for servicing. The hoods run back to larger windshields, said to give 12 per cent more vision than before. Wipers are mounted at the bottom instead of at the top. In the interior of the front compartment, there is a new instrument panel with controls recessed to avoid projections. Three-spoke steering wheels with horn ring are supplied. The hand brake is located under the instrument panel in the middle. Special controls are provided for front-seat adjustment, so that a minimum of effort is required to make the desired changes.

Dome lights and switches have been supplanted by reading lights with the switch in the center post, and provision is made for an extra radio loud speaker in the rear compartment. Individual window ventilation is provided by ventilating wings, while in the rumble seat coupe, the rear window can be lowered.

Read-end design is clean, with nothing bulging to break the lines, although ample luggage compartment space is provided. Spare wheels are mounted upright in the compartments to give more space for large packages.

Mechanical changes are in the nature of detail refinements, but among the more important is the enlargement of brake drums to 11 in. on the Royal, 12 in. on the Imperial, and 14 in. on the Custom Imperial.

Mechanical details will be found on page 598 of this issue.

Cites Body Problems

Oswald Outlines Future Car Developments

The body designer will continue to have an important part in the production of future automobiles whether or not there is a marked change in construction to the unit type, according to John Oswald, chief body engineer, Olds Motor Works, Lansing, Mich., addressing the Detroit section of the SAE on Oct. 18. Mr. Oswald urged greater cooperation between chassis designer and body designer in the interest of well-balanced automobiles.

The body of the future car may eventually contain all the principal members of the frame and the dividing line between chassis and body disappear, in which case the body designer will be responsible for a greater unit, said Mr. Oswald. Even if that development is far away, the present need to provide large space for chassis units and for accessories such as heaters and radios, without taking up too much passenger space and limiting accessibility, provides a major problem for the body designer, he pointed out.

The rear engine car appears to have many advantages and may prove to be a solution to some of the problems of the body designer, but it cannot become an actuality as long as there is the necessity of using the present type engines, axles, transmissions and driving mechanism and of accommodating them to the wheelbases which are accepted as standard in car design, according to Mr. Oswald.

"It is quite obvious," he said, "that the unit construction, whether it be for rear engine, front wheel drive, or standard propelled design, is more expensive to build and service, with no advantage in economy of maintenance or manufacture. And with unit construction, there is the handicap of creating from year to year, style changes without exorbitant tool cost. With our present type of construction, keeping the frame and chassis an individual unit from the body, we derive a great deal more flexibility for making changes and improvements in appearance and manufacture, whether on the body, chassis, or both."

40 Years Ago

with the ancestors of AUTOMOTIVE INDUSTRIES

The Trolley Road Wagon

Part 2

The ordinary trolley pole may also be used, but the cable permits of running the wagon on either side of the ordinary road, allowing it to meet or pass vehicles without difficulty.

The four-wheeled wagon has wheels 48 inches in diameter. The rear wheels are fastened to a shaft geared to a spring-suspended motor. The motor is a two-horsepower one of the Westinghouse crane type. In front of the motor a commutator controller is suspended, the handle of which is within easy reach of the person steering the wagon. . . . The generator used was a five horsepower compound wound Westinghouse 500-volt dynamo. It is said that on the trial trip a speed of fifteen miles an hour was reached with a load of 2500 pounds on the wheels. The control of both the motor and the steering apparatus was all that was desired. The trolley moved easily over the wires and there was no difficulty with the "pass-bys."

From *The Horseless Age*, Oct., 1897

Graham for 1938

NEW treatment of front and rear end characterizes the Graham for 1938. Fenders are deep-drawn and mount the headlights high at the front. Tail lights too, are mounted high on the body. Heavy bumper guards are provided.

Completely new styling from front to rear and a number of mechanical changes mark the new Graham cars for 1938. The line consists of two engines, the Special and the Supercharger, both mounted on a chassis of 120-in. wheelbase. Optional equipment is a vacuum-operated gearshift with a short shifting lever mounted on a bracket just below the instrument panel.

Frontal appearance of the new cars is entirely different from preceding models. There is no radiator grille as such, bright-finished strips running backward from the rounded and undercut forward portion of the hood. Air enters through slots between the strips. Front fenders follow closely the profile of the front end with headlights set into the foremost portion of the fenders and somewhat forward of the bottom edges. The lower fender line does not describe a circle to accommodate the front wheel but partly covers the wheel. All rear forms are rounded and rear wheels are enclosed. Running boards are wide and separate from the fenders; the top is seamless steel.

Special efforts are directed at safety with the result that many edges and projections have been eliminated inside and outside. The wide rear tread of 61¼ in. makes possible seats 57 in. wide. Plastics are used in interior decoration.

Seating is mid-section, between the axles, while the windshield is wide and sharply raked and windows are large. The body design makes possible a large luggage compartment which also contains the spare wheel. Mechanical details are on page 583 of this issue.

Sees New Fare Curbs

J. L. Rogers Hits Destructive Rail, Bus Competition

Further regulation of railway and bus passenger fares with a view to eliminating destructive competition between the two systems was forecast by John L. Rogers, member of the Interstate Commerce Commission, in an address to the eleventh annual meeting of the National Association of Motor Bus Operators, held at the Congress Hotel, Chicago, Oct. 13 and 14.

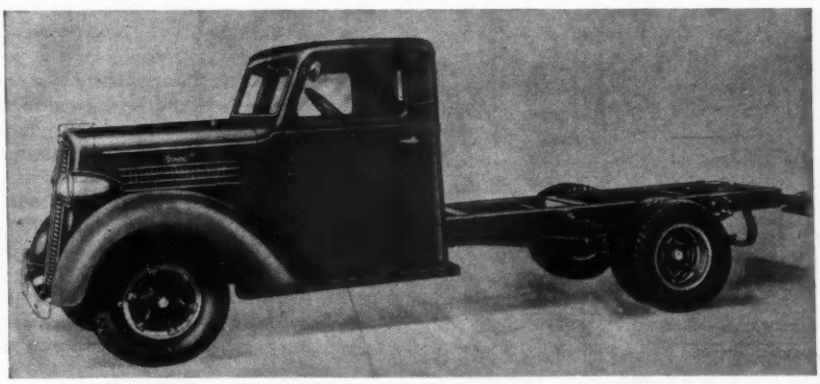
"The day may come when all passenger traffic must pay for itself," declared Commissioner Rogers. "In the past the Interstate Commerce Commission's duties have been to protect the public, both the traveler and shipper, from unfair rates. Now it should protect the nation by preventing its own transportation agencies from engaging in destructive competition. The Interstate Commerce Commission should determine the cost of transportation and fix rates for each form of transportation so that it will pay its own cost."

President Arthur M. Hill of Charleston, W. Va., in his address declared that simplification of procedure before the Interstate Commerce Commission is necessary to eliminate the long and costly delays in securing hearings and decisions.

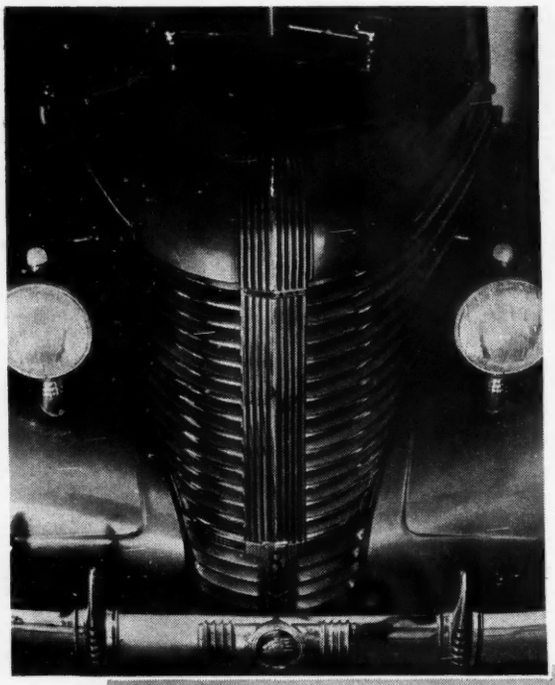
A. M. Hill, president of the Atlantic Greyhound Corporation, Charleston, W. Va., was re-elected president of the association. E. W. Wakelee, vice-president of Public Service Coordinated Transport, Newark, N. J., was re-elected vice-president and E. D. Merril, president and general manager of Capital Transit Co., Washington, D. C., was re-elected treasurer of the association.

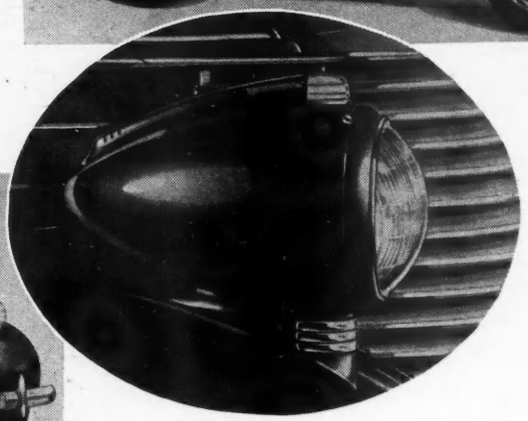
Truck Signal Case Won

The Massachusetts Supreme Court decided on Oct. 15 that the commissioners of the Department of Public Works have not the authority to order the equipment to be used on commercial vehicles. It appeared that the effect of the decision might be extended to all cars and trucks. The case arose out of a fight against a department order requiring certain signaling devices, and the court ruled that the law as it stands covers the "movement" of certain vehicles and not the vehicles themselves with their equipment.



NEW MODEL in the Stewart truck line. It is Model 61-A in the 1-1½ ton range and has a standard wheelbase of 123 in. with a wheelbase of 132 in. optional. Special wheelbases of 140, 145 and 163 in. are available. The engine has six cylinders, is rated at 65 hp. at 2800 r.p.m. Four forward speed and reverse and full-floating rear axle are provided. Standard wheels are 16-in.





PONTIAC styling has been refined for 1938, the designers retaining the "silver streak" appearance of the car. At the left is shown a frontal view of the eight including the new headlight treatment, the detail of which is illustrated at the lower right. Upper right view is a six cylinder sedan with trunk while at the lower left is the similar model in the eight cylinder line.

Refined body styling, adoption of a number of passenger-safety items and several mechanical improvements feature the Pontiac Six and Eight for 1938.

Chief items in the list of safety developments are a rolled-edge instrument panel with recessed control knobs, a soft roll on the back of the front seat, a safety robe cord and flat window controls.

Major mechanical change is the introduction of an optional gear shifting linkage with the lever mounted just under the steering wheel. The only change in operation is the cross-over movement of the lever, which is up and down instead of crosswise. The lever is directly connected with the transmission through a flexible cable. This change in the control is accompanied by detail changes in the cluth and transmission for easier operation.

Body styling is basically similar to that of the preceding model, but now involves placement of the headlights on brackets on the front fenders, those on the eight carrying parking lights on top of the headlights. The "silver streak" styling is retained, with bars running backward from the radiator grille to the back of the hood. Hood sides are normally fixed, but can be removed for servicing. The battery is mounted on the hood ledge beside the engine and is of the end-to-end type. Defrosters are now located in the windshield garnish molding and have longer outlets to handle the larger output of the blower. Mechanical details will be found on page 586 of this issue.

Vauxhall Has Small Car

A new four-cylinder car has been introduced by Vauxhall, British division of General Motors Corp. The car is known as the 10/4, rated for British tax purposes at 10 hp. and has a wheelbase of 94 in.

Appearance is characteristic of the Vauxhall line. It is offered in three passenger models, a standard sedan, deluxe sedan and a coupe, while in addition there is 600-lb. capacity panel delivery model which carried the frontal appearance of the Bedford truck line.

The entire line has independent front suspension, the truck model the first commercial car in England with that type springing. Springing is the torsion bar and torsion tube type. Engine is of the overhead valve type. Brakes are hydraulic.

Foreign Cars at Show

European representation at the New York Automobile Show will include several models of the French Talbot-Royal and three Italian Fiat models.

Financing Over 1936

Volume of automobile financing, wholesale and retail, declined seasonally in August from July, but all classifications showed gains over August, 1936. Used car retail financing has been consistently above 1936.

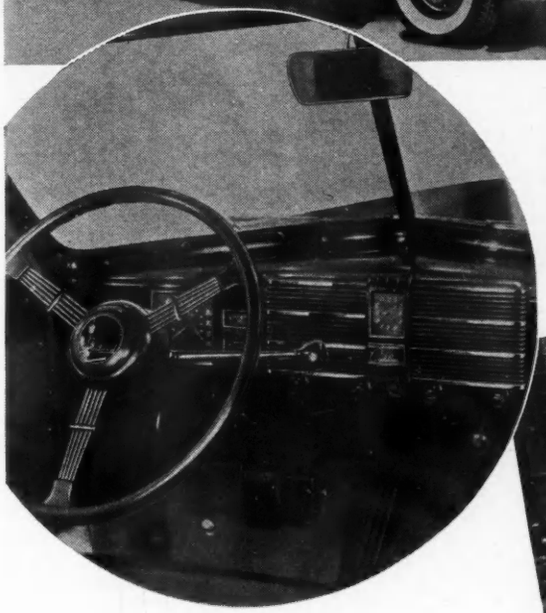
Total wholesale financing was $161,539,141 in August against $172,145,221 in July, and against $129,865,102 in August, 1936. For eight months the total wholesale financing was $1,374,979,848 against $1,251,664,152 in the 1936 period.

Retail new car financing in August was $99,000,881 or an average of $595 per car, the highest since October, 1936, against $106,865,064 in July and against $94,017,673 in August last year. Total retail new car financing for eight months was $778,101,203 against $792,880,439 for last year.

Retail used car financing for August was $63,161,963 or $280 per car, the same per car figure as for July, against $66,616,294 in July, and against $52,123,841 or $255 per car in August last year. The total for eight months was $503,257,014 against $419,961,282 for the 1936 period.

New Boeing Bomber

Boeing Aircraft Co., Seattle, has completed for the U. S. Army a new four-engined bombing plane known as the XB-15. It is 90 ft. long and has a wing spread of 150 ft. Power is provided by four 1000-hp. twin-row Pratt & Whitney Wasp Sr. engines. There are also two gasoline engines located inside the airplane driving generators.



CADILLAC-LaSALLE line for 1938 includes a variety of models. Upper left is a LaSalle sedan while just below is a view of the new gear shift lever mounting under the steering wheel, which is on the entire line. Upper right view is a Cadillac 65, center right is the new Cadillac 60, made in the one completely new body style shown, and lower right is the Cadillac Fleetwood 75. All engines are V-8's excepting for the new V-16.

Cadillac-LaSalle cars for 1938 are newly styled and incorporate a number of major mechanical changes and the several series have been rearranged.

Common to all lines is a new location for the gear shift lever, which is now mounted just under the steering wheel and is directly connected to the transmission. The only change in the operation of the shift lever is that the selecting motion is up and down instead of transverse, while the gear engaging motion is sideways instead of fore and aft.

The new Cadillac 60 is produced in only one body style, a touring sedan which is made with especially slender body pillars, no running boards and a rounded rear portion with large built-in trunk. Fenders are long and swept rearward. The radiator grille is large and runs back part way along the hood sides, its lines carried out by similarly designed louvres. Through the use of a double-drop frame the over-all height of the car has been held to 5 ft. 5 in.

LaSalle styling is new and includes higher catwalks between fenders and radiator, with headlights mounted on them; a wider radiator grille which adds 19 sq. in. to the cooling area, an "alligator-type" hood which is hinged at the rear edge, and new sheet metal elsewhere. Dashboard controls are recessed for safety. Accessibility of equipment is featured, with the battery located under the hood.

A new Cadillac V-8 supplants the former series 65, which was produced in only one body model. There are three body types, on a wheelbase of 132 in. Front-end design consists of a large die cast radiator grille, headlights mounted above the fender catwalks, fenders separated from the running boards, stainless steel louvres, and an alligator-type hood.

Fleetwood bodies on the Cadillac 75 are wider and longer than before and the car is powered with a 140-hp. engine, compared with the 135-hp. engine used in the series 65. The difference is achieved by raising the compression ratio for the Fleetwood series. The LaSalle is powered with a 125-hp. V-8 engine. The V-16 is entirely new and uses a 135-deg., L-head engine. The car was described in AUTOMOTIVE INDUSTRIES, issue of Oct. 16. Mufflers on all series are now placed transversely, permitting a lowering of bodies without affecting road clearances. Instrument panels on all models introduce colored plastics, with recessed controls. Radio controls and connections for windshield defrosters are standard. Mechanical details of the line will be found on page 590 of this issue.

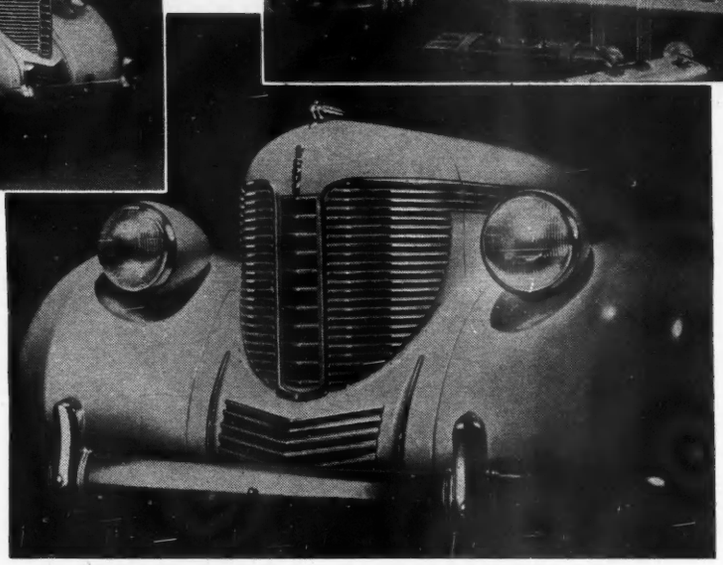
Puerto Rican Car Trade

Sales of American-made automobiles and trucks to Puerto Rico continued at a record-breaking rate during the first eight months of 1937, according to the Puerto Rican Trade Council. "Shipments to the Island during the eight month period increased 28 per cent in number and 33 per cent in value, compared with the same months of 1936," the report states. "The sales totalled 2873 cars and trucks, valued at $1,969,000.

Rim Inspections

Rim inspections by the Tire and Rim Association for September totaled 1,131,086 in the 16-in. and smaller sizes, or 77.6 per cent of total inspections, against 816,898 or 74 per cent of all inspections for September, 1936. For 9 months, rims inspected in that class totaled 13,845,218 or 79.4 per cent of the total, against 8,973,483 or 60.6 per cent of the 1936 total. Twenty-inch truck rims were the largest category, numbering 252,-470 or 17.2 per cent of inspections, against 228,898 or 20.7 per cent a year ago. For 9 months such inspections were 2,785,189 or 16 per cent, against 2,638,194 or 17.8 per cent of 1936 inspections.

DE SOTO for 1938 has a newly styled front end involving horizontal chromium bars running backward at the top for the hood louvres. Front fenders are deeply drawn and have a slight ridge at the crown with headlights mounted on them just inside the ridge. Wheelbase, at 119 in., is three inches longer than before. At the rear, the spare wheel is mounted in an upright position permitting more useful space arrangement in the luggage compartment.



DeSoto is announcing a restyled line for 1938 with a 119-in. wheelbase, three inches longer than before. Bodies are mounted on a new frame of heavier proportions, and greater use is made of rubber for insulation against vibration and noise. Steering arrangements are new and are said to eliminate road shock at the wheel.

Radiator grille, die cast, and new front end sheet metal treatment characterize the entire line. Front fenders are set wider apart than before permitting the headlights to cover a wider area. The hood is hinged at the center and opens from the side, having bolted-in-place side panels which have a structural function and make possible elimination of radiator tie rods. Windshield has been made an inch deeper, adding to the driver's vision.

Particular emphasis has been placed upon the legibility of the numerals on the instrument panel and they are lighted through from the back for night driving. Controls are grouped in a recess below the middle of the panel so that knobs are flush with the panel surface. Defroster vents are larger than before. The position of the handbrake is under the instrument panel at the driver's right and the brake itself is of "pistol-grip" type. Hydraulic service brakes are stated to be 10 per cent larger than last year and are applied with a lighter pedal pressure.

Front end independent suspension has been redesigned for rigidity and further improved riding qualities, with the use of rubber extended and many joints sealed against the entry of dirt and water. Rubber is also used in the steering gear housing to eliminate road shocks. Efforts to keep the clutch free of oil and water vapors have been made through the use of a new baffle plate, and clutch pedal action has also been softened.

DeSoto is accenting its bodies with small color applications at several points, both outside and inside the cars. Considerable use is made of die castings and chromium in the interior trim.

Mechanical details of the new DeSoto cars will be found on page 584 of this issue.

Willys Commercial Line

Willys-Overland Motors, Inc., has entered the commercial car field with two different lines, the one headed by the Economy Cab Pick-up and the other to be known as the Willys "Half-Tonner" line.

The Economy line is built on the standard passenger car chassis with the only change use of a heavier rear spring with eight leaves to carry the increased load. Tire equipment is 5.50 by 16 in. with 3¼-in. rims.

The Half-Tonner line includes a stripped chassis, chassis with cowl, chassis with cab, and a Half-Tonner Pick-Up complete. In addition, a door-to-door unit will be introduced, probably by the first of the year, on the half-ton chassis. The Half-Tonner line features a heavy-duty rear axle with a standard ratio of 4.7 to 1 and 4.9 and 5.1 to 1 optional, modified steering ratio, 10-leaf, two-stage rear springs, and heavier wheel and tire equipment. Wheelbase is 100 in.

Wage Costs Still High

Payrolls Drop Seasonally For September

Michigan automobile plants reported a decline in the number of workers employed from August to September and a larger decline in weekly payrolls, though both figures were well above the levels for September, 1936. The changes were probably due to the early September changeovers to new model production following large August assemblies of 1937 cars. Plants in the state making automotive parts and automobile tires showed small gains in employment and payrolls from August to September, anticipating actual car assembly operations.

The trend toward higher labor costs has apparently not been checked as payrolls are up more than the increase in the number of employees, compared with figures for 1936.

In the 68 automobile plants which reported, there were on Sept. 15 a total of 246,806 employees, representing a gain of 23.5 per cent over the number employed a year earlier but a decline of 9.0 per cent from the August employment. Weekly payrolls in September averaged $7,960,963, a gain of

(Turn to page 204 in the advertising section, please)

E. P. Chalfant Says:

"The seasonal announcement of new models as automobile shows claim the National spotlight, prompts me to reflect how great a contribution these annual changes make to the business and mental health of our industry. Just as new models enforce changes in designs, dies and patterns, just as surely they force us to change our thought patterns, to use our imagination and bring a fresh point of view to familiar problems.

"Occasionally, a car owner grumbles that a new contour to his particular make of car depreciates the car he is driving. I am more inclined to agree with the inventive genius, Charles F. Kettering, who claims that the new models do not *depreciate* our cars but rather *step up our appreciation* of new things we can enjoy.

"Long conformity to one standard dulls our thinking and makes any business commonplace, stale and flat. Change is the law of nature and a requisite for healthy minds.

"Previews assure us that the 1938 cars bring driving pleasure to new high levels and set new standards in beauty and comfort. The industry itself is refreshed and invigorated by these new ideas so attractively presented in the graceful lines of next year's cars. We're fortunate to be a part of an industry where change keeps our attention riveted on the future rather than the past."

CHALFANT is executive vice-president of the National Standard Parts Association. Since 1926, when he took on the job, the association's membership has increased from 134 to more than 600. "Ned" Chalfant's friends were not surprised.

In 1907, as manager of the Association of Licensed Automobile Manufacturers—the Selden patent group—he cooperated with Alfred Reeves, then manager of the American Motor Car Manufacturers Association on legislative ground of common interest to both groups.

Later as general sales manager of Packard, as president of the E. R. Thomas Motor Car Co., in Government war work, and in many other responsible assignments, he demonstrated his ability to cooperate and to move with the times.

"Who wants to be a mossback?" was his retort to a friend who mentioned rolling stones.

"As Shows Claim the Spotlight . . ."

THE pages which follow in this issue of AUTOMOTIVE INDUSTRIES are all the concrete record of an annual miracle—designing and putting into production passenger cars which will replace older passenger cars in the hands of some four million of the world's alert and style-conscious citizens. Many pages have been given already to descriptions of engineering achievement in 1938 American automobiles. Many more pages in this issue are devoted to the same purpose.

But the next 12 pages are given to focusing attention on an often-neglected phase of automobile design—the men who are responsible, as directors of initiative, for that design.

It would be impossible, naturally, to show even in the space of a whole magazine of this size, the complete record of each of the men who contributed something to the year's new car designs. So we have sought earnestly and carefully to show in each case the man or small group of men who have, as closely as we could determine, the final responsibility for engineering design in the new products which will be shown at New York, and everywhere during the week of Oct. 24.

In one or two cases, company policies have prevented a picture being taken. In others, men at the top have stepped aside to insist that credit was due elsewhere. A few men were not available when the pictures had to be taken. With this prelude, we present—in the next pages—the men who designed the cars—which are the important thing—"as shows claim the spotlight."

Gentlemen, the engineers!

About the Pictures

Least photographed of the important executives in automobile-manufacturing plants are the chief engineers. Result: lack of good photographs for publication in a series like the one which follows. In view of this, AUTOMOTIVE INDUSTRIES sent its art editor, Geoffrey Grier, on a swing around the industry to get fresh, informal, exclusive pictures worthy of inclusion in a section which records the achievements of the men involved.

Unless otherwise noted, all of the photographs were taken by Mr. Grier, usually in the office or drafting room of the engineer involved. Hundreds of individual "shots" were made, not with the object of getting caricatured candid pictures, but something which would be informally typical of the man whose picture was sought.

Many an engineer-subject was found to be a miniature camera enthusiast himself. For the benefit of the other enthusiasts in the industry we record the fact that most of the pictures were taken on Kodak Super X Panchromatic film with a Zeiss Contax camera, equipped with an f. 1.5 lens. Normal interior lighting was supplemented in some cases by a color-corrected photoflood bulb in a small portable reflector.

Publicity and advertising departments, our Detroit staff, and (superbly) the subjects themselves cooperated in making the pictures the best possible informal album of engineering responsibility in the industry.

Chrysler *Engineering Executives*

THIS and the following page record once more a remarkable engineering relationship. With Fred M. Zeder, now vice-chairman of the Chrysler Corp., Skelton and Breer were members of a consulting engineering firm which made automotive engineering history. Woolson and Clark worked at various times with the same organization.

Mr. Skelton specializes on axles and transmissions. During his career he has been associated with Pope-Toledo, Packard, Studebaker (where he first worked with Fred Zeder). He went with Mr. Zeder to Willys in 1921 and Maxwell in 1923. He and Carl Breer were made directors of the Chrysler Corp. in June, 1937.

OWEN R. SKELTON
Engineering executive, Chrysler Corp.

THIRD member of the trio, Mr. Breer met Fred Zeder's orbit at Allis-Chalmers about 1912. He joined him at Studebaker in 1916 and went through the Willys and Maxwell period with him, prior to the organization of Chrysler. He was born in Los Angeles and graduated from Leland Stanford in 1909. His present Chrysler responsibilities center on research.

CARL BREER
Engineering executive, Chrysler Corp.

HARRY T. WOOLSON

Executive engineer, Chrysler Corp.

MR. WOOLSON graduated from the Stevens Institute of Technology in 1897 with the degree of M.E.

Shortly thereafter he went to work for the National Meter Company of Brooklyn, New York, as a draftsman. A year later the Spanish-American War broke out and he served in the United States navy for the following six months as a machinist.

In 1915 he went to Detroit as truck engineer with Packard. His next position was with the Studebaker Corporation in Detroit in their engineering department. Next with Willys at Elizabeth, N. J., he later joined the Zeder-Skelton-Breer Engineering Company at Newark, N. J., and remained with them for a year.

OLIVER H. CLARK

Executive engineer, bodies, Chrysler Corp.

MR. CLARK studied drafting and became a chassis engineer for Amplex Automobile Co., Mishawaka, Ind. He then joined Studebaker, in charge of electric truck design, later moving to Detroit as assistant body engineer. He went to Willys in the same capacity 1920-22, returning to Detroit and Chrysler with the Zeder organization. Since then he has designed and built countless experimental bodies.

NEWTON F. HADLEY

Chief engineer, Plymouth

MR. HADLEY was born in New York, and after the usual preliminary education he attended the Case School of Applied Science at Cleveland. He also attended Ohio State University.

His first study of the practical aspects of automobile design was in the service department of Willys Overland in 1913. He later went with the experimental department of Studebaker, where he had charge of the physical laboratory.

From Studebaker he returned to Willys Overland, and later was with the Maxwell Chalmers organization as an experimental engineer. That began his connection with Walter P. Chrysler, which has been continuous ever since.

Dodge's *Allen*, Chrysler's *Maurer*

MR. ALLEN entered the industry by way of the Hudson Motor Car Co. student course in production, following the acquisition of a B.S. in engineering from the University of Illinois. From Hudson he went to Chalmers. Beginning in 1916, he was associated with the Liberty Motors Car Co. and responsible for its designs for a matter of five years—one year, before the World War, as assistant chief engineer, and four afterwards as chief.

Allen was a Captain, Army Ordnance Department, engineering division, during the war, and aided in track laying truck development on this side, while in France he had charge of all experimental testing in connection with the transportation of motorized field artillery. He received a citation for efficiency in connection with the last-mentioned detail.

Development of a new four-cylinder engine for the Dodge organization first engaged his attention there in 1923 and 1924. Thereafter, he became successively, chassis and experimental engineer, experimental engineer and then attained his present post of chief engineer as of 1929.

GEORGE B. ALLEN
Chief engineer, Dodge

EDWIN R. MAURER
Chief engineer, Chrysler division

MR. MAURER has had a varied and interesting experience in the engineering field. A native of St. Louis, Mich., he graduated from the University of Michigan in the class of 1909 Engineering. His first connection with the automotive industry was as a member of the engineering staff of the Welch car, sometimes called "the first of the modern cars." This car, manufactured in Pontiac, had a six-cylinder engine with the cylinders cast in pairs and other features that were considered advanced for its time.

From the Welch concern, Mr. Maurer entered the heavy machinery business. Then he went with the Solvay Process Co. for a time. Returning to the automotive field he was successively with Studebaker and Buick. About seven years ago he joined the Dodge engineering staff, truck division. He has held his position as chief engineer of the Chrysler Division for about two years.

De Soto's *Woolson*, Bantam's *Hazzard*

IRVING WOOLSON graduated from Cornell University in 1927. Shortly after leaving school he spent some time in the construction and mechanical departments of the American Smelting and Refining Company in New Jersey. He started his automotive career in 1928 when he entered the design department of the Chrysler Corporation at the Highland Park plant.

After two years with the Chrysler Corporation, he was transferred to the Dodge Division in the bus and truck engineering departments. In 1932 he became general assistant on car chassis for the Plymouth division.

He was appointed chief engineer of the De Soto division in the fall of 1936.

IRVING WOOLSON
Chief engineer, DeSoto

H. I. HAZZARD
Chief engineer, American Bantam Car Co.

MR. HAZZARD went with American Bantam from Lycoming Motors. With Walter T. Fishleigh of Detroit as consulting engineer, he has been responsible for the design of the American Bantam, soon to be shown. His work with Bantam has been asknowledged by his recent official appointment as chief engineer, a position he has held in fact for several months.

General Motors: The *Hunt Brothers*

WITH C. F. Kettering (who was in Europe as these pictures were being taken) and his brother, below, O. E. Hunt shares the final engineering responsibility for G.M. products. He became a vice-president of General Motors in 1929 and was made a director of the corporation in 1934.

He began his engineering career in the construction industry. In 1909 he went to Packard where, in nine years, he progressed to chief engineer of the car division. After war work as chief engineer on Liberty aircraft engine design and production he returned to Packard. From 1921 to 1929 he served General Motors as chief engineer of Chevrolet, from which position he was advanced to his present one.

O. E. HUNT
Vice-president, engineering, General Motors

JOHN H. HUNT joined General Motors in 1920 when he came to the corporation's research laboratories as a section head. In 1928 he became engaged in engineering work in the patent section and in 1932 assumed his present position.

Before coming to Detroit, Mr. Hunt was associated with the Dayton Engineering Laboratories Company. He prepared for electrical engineering at the University of Michigan, and most of his early training was in the electrical equipment research field.

He has been prominent in the Society of Automotive Engineers, serving as president in 1927, and he is the present chairman of the society's publication committee.

JOHN H. HUNT
Head, New Devices Section, General Motors

Buick's *Chayne*, Cadillac's *Seaholm*

Photo courtesy Frank Webb, Buick

CHARLES A. CHAYNE

Chief engineer, Buick

MR. CHAYNE joined Buick in 1930 as motor engineer. He was made assistant chief engineer in 1933 and continued in that position up to the time of his appointment as chief engineer.

Graduated from the Massachusetts Institute of Technology in 1919 with a degree in mechanical engineering, Mr. Chayne taught automotive engineering at the institute until 1926. In 1927 he joined the Lycoming Manufacturing Co. as experimental engineer. Later that year he became engine designer for the Lycoming Co.

ERNEST W. SEAHOLM

Chief engineer, Cadillac

MR. SEAHOLM was born in Sweden, but was brought to the United States at the age of two. His formative years were spent in New England, where he graduated from one of the first technical high schools in the country, the Mechanics Art in Springfield, Mass. After apprenticeship and service with various New England plants, he joined Cadillac in 1913. Except for a year as chief engineer for Parker Rust Proof, he has remained continuously with Cadillac since 1922 as chief engineer.

Chevrolet's *Crawford*, Olds's *Youngren*

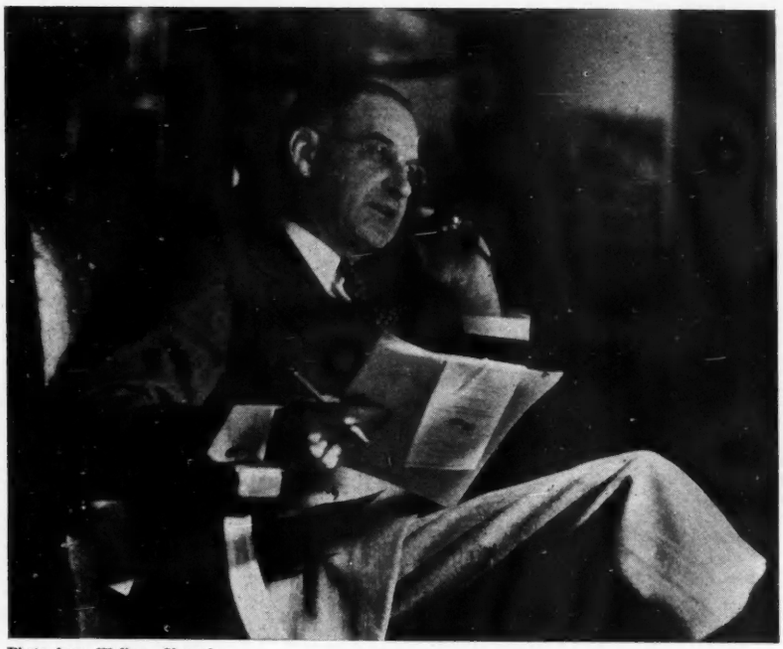


Photo from Walker, Chevrolet

JAMES M. CRAWFORD

Chief Engineer, Chevrolet

AMERICAN MOTORS, Chalmers, the Allen Motor Co., and the Auburn Automobile Co. were the scenes of Mr. Crawford's activity before he joined Chevrolet in 1929 as assistant chief engineer. Two years later he was appointed chief engineer. He has served the Society of Automotive Engineers as vice-president representing the passenger car engineering activity and as a councilor. His other interests in the society have centered around tire and rim standardization.

HAROLD T. YOUNGREN

Chief engineer, Oldsmobile

BORN in California, Mr. Youngren reversed the usual trek and came eastward to work. His first connection with the industry was as a draftsman for Allis-Chalmers. From then until the War the sequence was: Westinghouse, Falls Motor Co. and Harley Davidson. During the war he was a designer for the Curtiss Aeroplane and Motor Co. at Buffalo and Garden City, N. Y.

From 1920 to 1926 he occupied himself in the development of the Houdaille shock absorber, and with chassis and engine design for Pierce-Arrow. A period with Studebaker as consulting engineer and executive engineer on passenger car chassis design preceded his joining Buick as assistant chief engineer. His appointment as chief engineer of Olds came in November, 1933.

Pontiac's *Anibal*, Graham's *Kishline*

BENJAMIN H. ANIBAL
(Right)
Chief engineer, Pontiac

MR. ANIBAL was responsible for the design of the first Pontiac and more than a million and a quarter of them have come out under his direction since. The 1912 4-cyl. Cadillac, which carried the first electric starting and lighting, was one of the long series of "firsts" with which Mr. Anibal's name can be connected, and is part of the story of his 10 years with Cadillac, from 1911 to 1921.

Before Cadillac, there was Oldsmobile, and during the Cadillac period there was work on the Liberty motor and time in Washington with the aircraft division of General Motors. The picture shows Mr. Anibal with O. E. Hunt, vice-president of General Motors. Their association is of long standing.

F. F. KISHLINE
Chief engineer, Graham

MR. KISHLINE started his engineering career upon graduation from high school in Lincoln, Nebraska, when he obtained employment in the Cushman Motor Works at Lincoln and continued his technical studies in spare time.

By 1913, the motor capital beckoned irresistibly. He spent four years in the engineering departments of various automobile manufacturers such as the King Motor Company, the Krit Motor Car Company and the Saxon Motor Car Company.

The Graham Brothers were in the truck business at Evansville in 1919, and Kishline became their assistant engineer, remaining until 1922 when he went with Universal Products Corporation, Detroit, to handle sales and engineering. In 1926 he returned as assistant engineer in the Graham division of Dodge Brothers. When the Graham Brothers left Dodge in 1927 and bought the Paige Detroit Motor Company, to build passenger cars under their own name, Kishline moved with them.

Hudson's *Northrup*, Hupp's *Watts*

H. M. NORTHRUP
Chief engineer, Hudson

MR. NORTHRUP is chief engineer in charge of all engineering activities of the Hudson Motor Car Company.

He was appointed assistant chief engineer in 1929. He is a graduate of the Michigan College of Mining and Technology and after considerable experience in the motor car industry he joined the Hudson Motor Car Company in 1919.

In 1920 he was put in charge of a special division of the engineering department which is probably unique in the automotive industry. This department in addition to taking care of all physical, chemical and metallurgical experimental work for the engineering department, also has charge of all inspection of production materials and their physical, chemical and metallurgical characteristics and supervises the operation of all the heat treatment and similar highly specialized technical processes in the production department. He held that position until his appointment as assistant chief engineer.

FRANK E. WATTS
Vice-president and chief engineer, Hupp

MR. WATTS entered the automotive industry in the fall of 1901 in the engineering department of Halley Motor Company, Bradford, Pa., manufacturers of carburetors, motorcycles and high-speed gasoline engines.

From Halley Motor Company, went to J. W. Ruger Company, Buffalo, N. Y.—manufacturers of gas and gasoline engines and baking machinery.

In 1903, entered employ of Electric Vehicle Company and was successively with the Eisenthuth Horseless Vehicle Company and technical representative of the *Horseless Age*, first automotive tradepaper published in the English language—later absorbed by AUTOMOTIVE INDUSTRIES.

Went to the Hupp Motor Car Corporation, Nov. 10, 1910, as a member of the engineering department. Four years later was made chief engineer.

Elected vice-president and chief engineer, Hupp Motor Car Corp. in 1937.

Nash's *Wahlberg*, Pierce's *Maurer*

A NATIVE of Finland, Mr. Wahlberg graduated from the Ecole Polytechnique Federal in Zurich, and was working on gasoline engines before they had a real foothold in the United States. He came to this country in 1909 and went to work successively for Maxwell-Briscoe, E. R. Thomas (remember the Thomas Flyer?) and Packard.

After that he joined Oakland, where he rose to chief engineer and began an association with C. W. Nash which has lasted for 27 years. In 1916 when Mr. Nash ended his General Motors connection to found the company which bears his name, Mr. Wahlberg went with him to head the engineering activities.

Photo from Shaw, Nash

N. E. WAHLBERG
Vice-president, engineering, Nash Motors

METHODS and systems in Studebaker plants were Mr. Maurer's responsibility before he joined Pierce-Arrow in 1928. His eleven years with Studebaker were extremely varied including such things as charge of the chemical and physical laboratories, the experimental paint department, with tours as assistant works manager and assistant superintendent, body division.

Earlier connections included chief engineering on an experimental engine development in Chicago and with the Amplex Motor Car Co., once of Mishawaka, Ind. Mr. Maurer has been a member of the S.A.E. since 1910.

LE ROY F. MAURER
Vice-president, engineering and planning
Pierce-Arrow Motor Car Co.

Packard's *Vincent & Paton*

COLONEL VINCENT to hundreds, because his work during the war in connection with the Liberty engine has really influenced his times and his profession, far after the event; the Arkansan J. G. Vincent is unquestionably one of the best known engineers in the industry.

He learned his first engineering on a bench and continued his studies in correspondence schools, becoming superintendent of inventions for the Burroughs Adding Machine Co. Before joining Packard, he was chief engineer of Hudson. He is an engine man, and if the engines are racing engines, so much the better as far as he is concerned. Speed boats and airplanes have occupied a lot of his "spare" time in the past few years.

JESSE G. VINCENT
Vice-president, engineering, Packard

CLYDE R. PATON
Chief Engineer, Packard

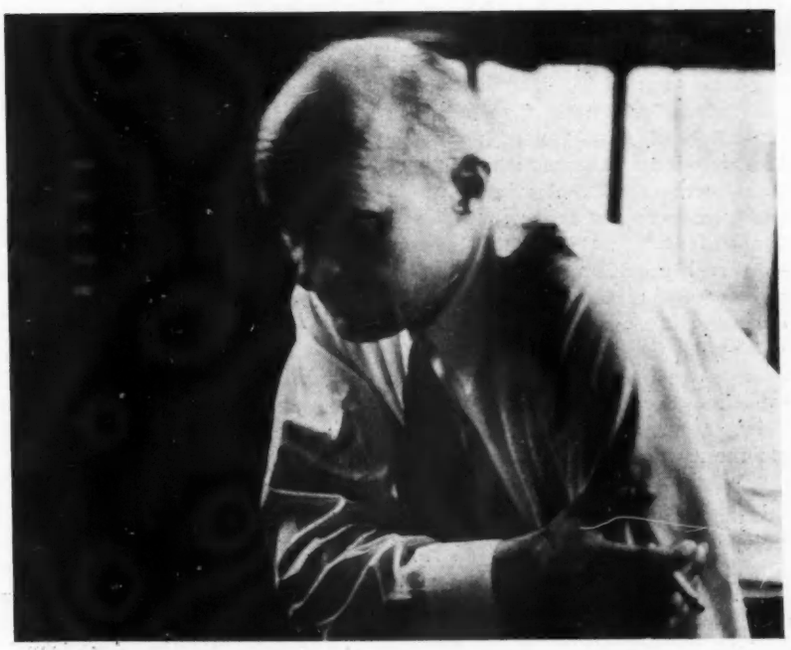
INVETERATE interest in internal-combustion engines has distinguished Mr. Paton's career. In the pre-war years he operated his own garage and electric service. The air service beckoned in the war years, and after preliminary training he joined the technical staff of the National Advisory Committee for Aeronautics.

He entered the automobile industry as a laboratory engineer for Studebaker in 1926 and joined Packard as experimental engineer in 1931, becoming chief engineer in 1933. He is the S.A.E.'s nominee for vice-president representing the passenger car engineering activity in 1938.

Studebaker's *Cole* & *James*

ROY E. COLE
Vice-president, engineering, Studebaker

EXPERIENCE with Chalmers, Continental Motors and as chief engineer for Dodge Bros. preceded Mr. Cole's appointment as chief engineer for Durant Motors, a connection which terminated in 1930. From that time until his recent Studebaker appointment as vice-president in charge of engineering the firm of Vail and Cole, consulting engineers, impinged on the automotive engineering activities of many companies, produced many a progressive idea in car design.



W. S. JAMES
Chief Engineer, Studebaker

AFTER graduation from George Washington University, Mr. James's early professional life was spent with the Bureau of Standards in Washington. In 1925, he joined the Associated Oil Co. as assistant technologist and in 1927 the Studebaker Corp. as research engineer. His appointment as chief engineer came in 1936.

Mr. James has been an extremely active member of the Society of Automotive Engineers. His committee memberships over the last 15 years total something like 75 man-years of activity. In 1937 he became vice-president of the Society representing the senior activity, passenger car engineering.

What Designers Have Done

in Passenger Car Development for 1938

By P. M. Heldt

A GENERAL survey of the changes in car design for 1938 cannot fail to leave the impression that a good deal of engineering work has been done on various chassis components, bodies, and items of equipment. Among the most outstanding changes must be counted the introduction of a controllable automatic transmission, an extension of the offer of power-shift transmissions, the mounting of gear-shift levers on the steering post, and the introduction of coil springs for rear suspensions. The automatic transmission and power-shift mechanisms on most of the cars are optional at extra cost, and their acceptance by the buying public this year probably will determine whether or not they are to become standard equipment later.

Numerous changes listed this year are the results of developments inaugurated a number of years ago and still in progress, such as efforts looking toward the more thorough insulation of the body against heat and noise, the provision of safety features both inside and outside the car, and features that make for greater convenience and ease of operation. Finally, there are a great many changes—mostly dimensional—that bear the earmarks of "correction." Engine horsepowers have been increased practically every year (an aggregate of about 75 per cent since 1927) but parts that are stressed by engine power are not always strengthened or enlarged in proportion immediately. Eventually certain parts begin to show evidence of weakness, and they must then be either made larger or of better material. Also, while I have no definite figures to prove the point, my impression is that the mileage life of the modern car is far greater than that of the average car produced well back in the Model-T era, say 1925. The engineer, of course, always aims to produce a well-balanced design, not only with respect to strength, but also as regards life of parts, and parts that wear out prematurely or give trouble at a relatively early stage of the life of the car as a whole, are made larger or improved upon in some other way.

48 Car Models for 1938

Before starting upon a detail discussion of engineering and style changes, it may be apropos to point out that with the decision of the Cord Corporation to retire from the manufacture of passenger cars, three more names disappear from the list of car specifications, one of which, Auburn, dates back almost to the beginning of the industry. One name (Hupmobile) reappears, and another one (American Bantam) is a new addition to the lists, although the type of car it represents has figured previously as the American Austin. The total number of car models will be 48 this year, as compared with 55 last year. The number of separate corporations manufacturing cars has actually increased, from 11 to 12, for only Cord Corporation has withdrawn, while Hupp Motor Car Co. and American Bantam Car Co. have entered the list. Counting the Hudson Terraplane and the Lincoln Zephyr, not as separate makes but as special models of the makes designated by the first half of their compound names, there were 22 makes of cars on the American market last year, and there are 21 now.

The average engine horsepower has decreased slightly this year, from 115.9 to 112. This, however, is due entirely to the disappearance of two unusually powerful cars, the 150-hp. Cadillac V-12 and the 265-hp. Duesenberg, and the advent of a car of abnormally low power, the 19-hp. American Bantam. If only models continued from last year are considered, the average horsepower has increased again, the same as in previous years. Compression ratios also increased again, from an average of 6.25 to 6.33, and engine rated r.p.m. increased from 3556 to 3570.

There have been obvious efforts to simplify manufacturing programs, especially among makers who produce on a moderate scale only. Cadillac, for instance, has dropped its twelve-cylinder model and has reduced the number of different wheelbase lengths, engine models, and chassis models figuring in its program. While the old Twelve has been discontinued, the new Sixteen in one sense has taken its place, for in wheelbase length and chassis weight it is closer to the old Twelve than to the old Sixteen. However, there has been no decrease in engine power as compared with the former Sixteen. Graham, which listed four models last year, is offering only two this year, and the only difference between the two chassis is that one carries a supercharger while the other does not. Whereas the line last year included three different engine models, there is really only one engine this year. Chrysler has dropped the Airflow model, which has simplified its line.

Some Things New in Engines

In engines the outstanding novelty is the new Cadillac V-16, in which the two banks of cylinders are mounted at an angle of 135 deg. The conventional angle for 16-cylinder V engines is 45 deg. Explosions are uniformly spaced with both a 45-deg. and a 135-deg. angle, and there is no difference in the mechanical balance. The question naturally arises: Why did Cadillac choose this new angular spacing of the cylinder banks? One definite advantage of the large angle is that it lowers the center of gravity of the engine, and therefore of the car as a whole, which makes for greater safety. However, the change in the center of gravity of the loaded car cannot be important, and it is doubtful whether this was the chief consideration in the matter. It is more likely that greater facility of mounting accessories and greater ease of producing the block were more weighty factors. The production of an engine block comprising the crankcase and sixteen cylinders is no mean accomplishment.

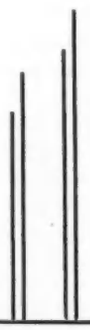
Two makers have lengthened strokes this year—Studebaker that of its six-cylinder engine by 1/16 in., Chrysler the strokes of two models by ¼ and ⅜ in. respectively. Increasing the stroke, of course, increases the piston displacement, and therefore the possible power output. However, the effect is most pronounced at low engine speeds and the chief result therefore is to improve the acceleration of the car. Increasing the stroke does not have the undesirable effect on the overall dimensions of the engine that an increase in bore has.

The new Cadillac V-16 engine is rather remarkable also by reason of the fact that it has dual accessories throughout—two air cleaners, two carburetors, two fuel pumps, two ignition units, two water pumps, etc., which should make it practically wholly immune from road failure. While the main bearings of the eight-throw crankshaft are naturally quite large, the crankpins have been held down in diameter sufficiently so that the connecting-rod heads can be passed through the cylinders. The crankpin diameter is equal to 61.6 per cent of the cylinder bore, which is about the limiting proportion permitting of this procedure.

In the past the greatest amount of development work in connection with combustion-chamber shapes has been done on L-head engines, where the adoption of the turbulence-type of head permitted of increasing compression ratios without running into excessive trouble from detonation. What tends to prevent detonation in such engines is that the combustion terminates in a shallow portion of the combustion chamber, between two closely adjacent metallic walls, which abstract heat rapidly and thus prevent the still unburned gas from attaining the temperature of self-ignition before the flame front arrives. In the valve-in-head engine it is more difficult to obtain a similar effect, but Buick now has developed a piston with a profiled crown which reduces the depth of the combustion space toward the side of the cylinder opposite that on which the spark plug is located. It has been suggested in the past to form the piston with a number of square steps at its top, but this has the disadvantage that it causes the gas pressure to force the piston strongly against the cylinder wall, which is obviated in the Buick design. The change in the form of the combustion chamber enabled Buick to raise the compression ratio and boost the power of its engines.

The move toward longer water jackets continues, as indicated by the practices embodied in the new Cadillac V-Sixteen and the redesigned Packard Super-Eight engine. If the jacket extends the full length of the cylinder, the barrel at mid-length lacks the support which is ordinarily provided by the bottom of the water jacket, and is therefore likely to be insufficiently rigid, especially during machining operations. Packard has taken care of this by providing a circumferential rib on the barrel at about mid-length.

In the engines of some of the Chrysler lines the valve timing has been changed to give an earlier inlet opening, evidently because it results in a higher volumetric efficiency. Cadillac has



Each Car Has Been Described

in AUTOMOTIVE INDUSTRIES, giving a complete picture of the 1938 offerings. Below is the list with date of issue and page number.

	Page	Issue
Buick	520	Oct. 16
Cadillac, LaSalle	590	Oct. 23
Chevrolet	594	Oct. 23
Chrysler	598	Oct. 23
DeSoto	584	Oct. 23
Dodge	518	Oct. 16
Graham	583	Oct. 23
Hudson, Hudson Terraplane	528	Oct. 16
Hupmobile	361	Sept. 11
Lincoln-Zephyr	596	Oct. 23
Nash	526	Oct. 16
Oldsmobile	480	Oct. 9
Packard	458	Oct. 2
Plymouth	589	Oct. 23
Pontiac	586	Oct. 23
Studebaker	394	Sept. 18

adopted the rubber-type of torsional vibration damper, which has come into general favor on account of its simplicity and also because it seems to effectively damp out vibrations of different frequencies. A new type of vibration damper has made its appearance on the Cadillac V-8. It is incorporated in the flywheel and is intended to damp out transverse vibrations of the crankshaft, a type that heretofore has been largely ignored by engine designers, except in so far as efforts have been made to minimize it by making crankcases stiffer in the transverse direction.

Heretofore the Tocco hardening process has been used mainly in the hardening of crankshaft journals of heavy-duty engines, but Packard now applies it to the hardening of camshafts. Chevrolet in its latest engine provides better facilities for cooling the exhaust-valve head, by providing a larger fillet between head and stem and increasing the contact areas between stem and guide and between guide and cooling water, as well as by eliminating the projection of the guide into the valve pocket. A new type of compression ring is making its debut on a number of engines this year. It has a shallow groove at the inner, upper corner of the section extending all around the ring, and, besides, the radial thickness is greater than in conventional rings.

Out of 46 models for which data on the subject are available, 12 are regularly fitted with aluminum cylinder heads, while on six other models these heads (with increased compression ratios) are available at extra cost. Graham, pioneer of the aluminum head, has increased the number of studs holding the cylinder head in place from 20 to 33 (for a six-cylinder engine). This is said to reduce cylinder-bore distortion due to the tension of the retaining studs, and, of course, it also serves to hold the cylinder-head gasket in place more firmly preventing gasket blow-outs.

Carburetion Received Attention

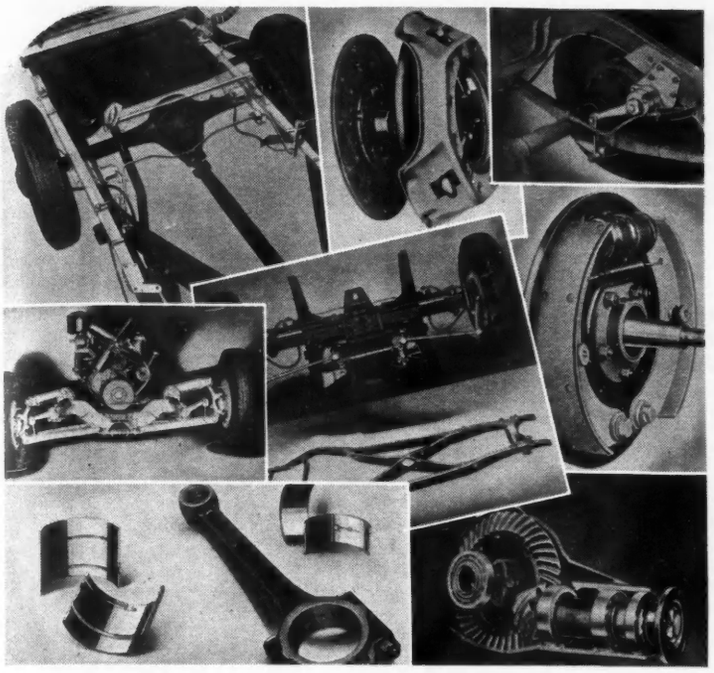
A number of changes in carburetor design are featured on 1938 cars. Several models carry a carburetor with a metering pin which heretofore was controlled by a mechanical connection to the accelerator pedal. The metering characteristics of a carburetor depend most directly on the degree of vacuum in the venturi, which is affected by both the throttle position and the engine speed, and the mechanical control of the metering pin therefore has been discarded in favor of vacuum control. As this will permit of a more accurate control of the mixture ratio, it should result in increased average fuel economy. On the Pontiac an additional fuel nozzle has been introduced to eliminate a "flat spot" in the power curve where the main nozzle takes over the work from the idling nozzle. A similar effect is obtained on the Buick by so arranging the idling jet that it delivers fuel throughout the speed range. Considerable difficulty is often experienced in getting an engine started again a short time after it has been shut down following a hard run. This is generally due to vapors forming in the fuel passage ahead of the metering orifice, as a result of heat flow from the engine block to the carburetor. Most manufacturers provide against this by the interposition of a heavy layer of heat-insulating material between the flanges of the carburetor and inlet manifold. In the Cadillac an additional safeguard against this occurrence is now provided by increasing the cooling facilities of the metering jet. Graham, in order to prevent vapor lock, provides a heat baffle between the exhaust manifold and fuel pump, which forms an integral part of the engine pan.

As regards the electrical system, the cry for larger output, which has been heard now for several years, has at last been heeded by the manufacturers, and larger generator capacities are featured by Chevrolet, Hudson, Packard, Pontiac and Plymouth, among others. In some cases the average output is raised without change in the size of the generator, by providing voltage control instead of the straight third-brush control, which latter decreases the generator output as the speed increases beyond a certain point. A good many manufacturers now mount the battery under the hood. Hudson, which introduced this practice last year, asserts experience has shown that with it—and the provisions for ventilation made in its installation—there is less frequent need for water additions than with the conventional mounting under the floorboards. A steady flow of cooling air evidently is necessary when the batteries are located in this position, and this is usually provided. Generator drive is now by means of the fan belt, as a rule, but in the new Cadillac V-16 there is a compound drive, through the fan belt and a friction gear. Hudson has made a number of changes in its ignition equipment. The coil has been redesigned so it will give satisfactory ignition with spark gaps of considerably more than the usual width. Emphasis has been laid in recent years on the fact that with an increased width of spark gap it is possible to run on a somewhat leaner mixture. Besides, the ability of the coil to deliver a spark across a wider gap has the advantage that the spark plugs need not be adjusted or replaced so soon.

As to Other Details—

For some years past there has been evidence of a conflict between engineering and appearance requirements at the front end of the car. The exposed radiator core is a thing of the past, and the core is now hidden from view by some sort of "grille," which, of course, must let air pass freely, hide the core, and be attractive in appearance. It seems that in some cases the former requirement has not received its due share of consideration, and that with increase in engine power the cooling capacity has become inadequate. Another thing that has a bearing on this situation is that with an increase in the length of the water jackets (to "full length" in a good many instances) a greater proportion of the heat liberated by the combustion of the fuel enters the jacket water and must be dispersed by the radiator. At any rate, the cooling capacity has been increased this year in a number of models. Packard has introduced a new feature in cooling systems by providing an air tunnel which allows air entering the engine compartment through the radiator, to escape under the running boards. By making it easier for the air to get out of the compartment, the rate of flow through it is increased. Hudson has increased its cooling capacity by a change in core design and an increase in the frontal area, while Pontiac has adopted a more powerful fan (with unequal spacing of blades, for the sake of more quiet operation). The movement away from the old stuffing-box-type of pump continues. On the Packards a new water pump has larger capacity and is provided with ball bearings and a packless seal, while Hudson pumps have a synthetic-rubber-and-cork seal. Graham has changed the location of the thermostat and now places it in the rubber hose leading to the top of the radiator, instead of in a metal fitting at the front of the cylinder head. All Packard lines now have radiator shutters controlled by thermostat, so that the cooling effect is regulated by controlling the air flow through the radiator, rather than the flow of water through it.

(Turn to page 600, please)



Mechanical Specifications of the 1938 American Passenger Cars

IN presenting herewith thirteen pages of mechanical specifications of the 1938 American passenger cars, AUTOMOTIVE INDUSTRIES achieves what the editors believe to be several significant "firsts." To the best of our knowledge it is the first magazine to reach the street with mechanical specification data on the new models. Secondly, this is the first time we have been able to present these data before the opening date of the New York show. Finally, examination of the tabular matter will reveal it to be more complete and more accurate than similar tables we have published outside of our annual Statistical Issue.

Credit for this achievement we attribute wholeheartedly to the splendid cooperation of personnel components of the automotive industry, including advertising managers, sales managers, engineers, publicity representatives, and parts manufacturers. Further, we wish to acknowledge the excellent work of Marcus Ainsworth, statistician of AUTOMOTIVE INDUSTRIES, and his assistant, Edward Osterhoff.

Readers have requested us to clarify the meaning of several of the column headings which appear in the tables.

Under general and engine specifications appears the heading Crankshaft Revolutions per Mile. This is calculated by means of the equation:

$$\text{R.P.M.} = 20{,}170 \times r/d$$

where r is the rear axle ratio and d the effective wheel diameter in inches. The constant 20,170 represents the quotient of the number of inches in the mile (5280 × 12) by the value of pi (3.1416).

The Displacement Factor is calculated by the equation:

$$F = 3825\ V\ r/W\ d \text{ cu. in. per ton-ft. under gas pressure}$$

where V is the displacement of the engine in cu. in.; r, the rear-axle ratio; W, the weight of the car in the dry condition, plus 400 lb. for two passengers and supplies; and, d, the effective diameter of the driving wheels in inches. The constant 3825 results from the conversion from pounds to tons, and from inches to feet; it also includes the value of pi (3.1416), and takes account of the fact that only every second stroke is performed under gas pressure.

Weight Per Cu. In. is a rational criterion of the maximum speed and liveliness of a car. For instance, if one has a car of given weight and then equips it with an engine which, without changing the weight has, say, 20 per cent more power, the maximum speed of the car will be increased, although not nearly in the same proportion. Inversely, when the car with the engine of greater horsepower is driven at the same speed, the engine operates at what is known as a lower power factor (smaller mean effective pressure) that is, less economically.

The Displacement Factor is more a measure of car acceleration from relatively low speeds in high gear. For example, if the rear-axle reduction ratio is increased without changing the engine, the weight per cu. in. is not changed but the displacement factor increases and the maximum possible acceleration at relatively low speeds is increased.

All corrections brought to our attention, along with manufacturers' revisions, will be incorporated into these tables when re-published in the AUTOMOTIVE INDUSTRIES' 20th Annual Statistical Issue which will appear Feb. 26, 1938.

GENERAL AND ENGINE SPECIFICATIONS

Line Number	CAR MAKE AND MODEL	Wheelbase (In.)	Tread (In.) Front	Tread (In.) Rear	Overall Length (In.) with Bumpers	Shipping Weight (Lb.) Cheapest 5-pass., 4-door Sedan	Tire Size	Gear Ratio 5-pass., 4-door Sedan	ENGINE: No. of Cylinders, Bore and Stroke (In.)	Valve Arrangement	Cylinder Arrangement	Cylinder Head Material	Piston Displacement (Cu. In.)	Taxable Horsepower	Maximum Brake Hp. at Specified R.P.M.	Maximum Torque (Lb.-Ft.) at Specified R.P.M.	Comp. Ratio (to 1) Standard	Comp. Ratio (to 1) Optional	Comp. Pressure (Lb.) Pressure	Comp. Pressure (Lb.) At What R.P.M.	Weight per Cu. In. 5 pass., 4-door Sedan	Weight per Hp., 5 pass., 4-door Sedan	Hp. per Cu. In.	Crankshaft Revolutions per Mile †	Displacement Factor ††	Line Number
1	Bantam....60	75	40	42½	129	.....	5.00/15	5.87	4-2.2x3.00	L	II	Al	45.6	7.75	19–4000	31–2000	7.00	No	90	150	.....	.....	.416	4700	.....	1
2	Buick-Special....38-40	122	58 7/32	59 9/32	200 1/16	3560	6.50/16	4.40	8-3 1/32x4 1/8	I	II	CI	248.0	30.63	107–3400	203–2000	6.15	No	126	1000	14.35	33.3	.432	3190	38.8	2
3	Buick-Century....38-60	126	58 1/16	59¼	203 1/16	3780	7.00/15	3.90	8-3 7/32x4 3/32	I	II	CI	320.2	37.81	141–3600	269–2000	6.35	No	130	1000	11.80	26.8	.441	2859	42.3	3
4	Buick-Roadmaster....38-80	133	59 11/32	62½	213¼	4245	7.00/16	4.18	8-3 7/32x4 1/16	I	II	CI	320.2	37.81	141–3600	269–2000	6.35	No	130	1000	13.30	30.2	.441	2922	39.3	4
5	Buick-Limited....38-90	140	59 1/16	62½	219½	.....	7.50/16	4.55	8-3 7/32x4 1/16	I	II	CI	320.2	37.81	141–3600	269–2000	6.35	No	130	1000	.....	.....	.441	3076	.....	5
6	Cadillac-V8....38-60	127	58	61	207 5/16	.....	7.00/16	3.92	8-3 1/16x4 1/8	L	V	CI	346.0	39.20	135–3400	250–1700	6.25	5.75	155	1000	.....	.....	.390	2740	.....	6
7	Cadillac-V8....38-65	132	58	59	211 5/16	.....	7.50/16	4.58	8-3 1/16x4 1/2	L	V	CI	346.0	39.20	135–3400	250–1700	6.25	5.75	155	1000	.....	.....	.390	3124	.....	7
8	Cadillac-V8....38-75	141	60½	62½	220 5/8	.....	7.50/16	4.58	8-3 1/16x4 1/2	L	V	CI	346.0	39.20	140–3400	266–1700	6.70	(a)	170	1000	.....	.....	.405	3096	.....	8
9	Cadillac-Sixteen....38-90	141	60½	62½	220 5/8	.....	7.50/16	4.31	16-3 1/16x3 1/4	L	V	CI	431.0	67.60	185–3600	324–1700	7.00	No	180	1000	.....	.....	.430	2914	.....	9
10	Chevrolet-Master.......	112¼	56 3/8	59	187 1/16	2845	6.00/16	3.72	6-3 1/32x3 3/4	I	II	CI	216.5	29.40	85–3200	170–(n)	6.25	No	.....	.....	13.15	33.5	.394	2777	35.7	10
11	Chevrolet-Master De Luxe.....	112¼	57¼	59	187 1/16	2935	6.00/16	4.22	6-3 1/32x3 3/4	I	II	CI	216.5	29.40	85–3200	170–(n)	6.25	.....	.....	.....	13.53	34.5	.394	3131	39.4	11
12	Chrysler-Royal....C-18	119	56 5/8	60 3/32	199 1/16	.....	6.25/16	4.10	6-3 5/32x4 1/8	L	II	CI°	241.5	27.34	95–3600	.....	6.20	7.10	145	1000	.....	.....	.394	2993	.....	12
13	Chrysler-Imperial....C-19	125	57 3/8	60 3/32	205 7/8	.....	6.50/16	3.91	8-3 1/4x4 1/2	L	II	CI°	298.6	33.80	110–3400	.....	6.20	(h)	145	1000	.....	.....	.368	2835	.....	13
14	Chrysler-Cust. Imp....C-20	144	58	63	224	.....	7.50/16	4.55	8-3 1/4x4 7/8	L	II	Al	323.5	33.80	130–3400	.....	6.50	7.45	155	1000	.....	.....	.402	3103	.....	14
15	De Soto....S-5	119	56 5/8	60 3/32	199 1/16	3134	6.00/16	4.10	6-3 5/32x4 1/4	L	II	CI°	228.1	27.34	93–3600	.....	6.50	7.00	145	1000	13.70	33.7	.407	3042	37.8	15
16	Dodge....D-8	115	55 11/16	60¼	196 11/16	2977	6.00/16	4.10	6-3 1/4x4 5/8	L	II	CI	217.8	25.35	87–3600	.....	6.50	No	140	1000	13.68	34.2	.400	3042	38.0	16
17	Ford (See note below)	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17
18	Ford.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18
19	Graham-Special.....	120	56 11/32	61¼	197	.....	6.00/16	4.27	6-3 1/4x4 5/8	L	II	Al	217.8	25.35	90–3600	.....	6.70	No	160	1000	.....	.....	.414	3168	.....	19
20	Graham-Supercharger.....	120	56 11/32	61¼	197	.....	6.50/16	4.27	6-3 1/4x4 5/8	L	II	Al	217.8	25.35	116–4000	180–3000	6.70	No	.....	.....	.....	.....	.534	3096	.....	20
21	Hudson-Terraplane....81	117	56	59	193 1/16	2885	6.00/16	4.11	6-3x5	L	II	CI	212.0	21.60	96–3900	170–1300	6.25	7.00	80	125	13.60	30.1	.452	3050	37.3	21
22	Hudson-Terraplane....82	117	56	59	193 1/16	2925	6.00/16	4.11	6-3x5	L	II	CI	212.0	21.60	101–4000	170–1300	6.25	7.00	80	125	13.80	29.0	.477	3050	36.6	22
23	Hudson-Six....83	122	56	59	197¾	3005	6.00/16	4.11	6-3x5	L	II	CI	212.0	21.6	101–4000	170–1300	6.25	7.00	80	125	14.15	29.7	.477	3050	35.9	23
24	Hudson-Eight....84,5,7	122, 129	56	59	(k)	(m)	6.50/16	4.11	8-3x4	L	II	CI	254.5	28.8	122–4200	200–	6.25	7.00	.....	.....	12.40	25.9	.480	2980	40.4	24
25	Hupmobile-Six....E	122	59 3/16	58¼	203¾	3370	6.25/16	4.54	6-3 1/16x4 1/4	L	II	CI	245.3	29.42	101–3600	.....	5.75	6.20	141	3000	13.75	33.3	.412	3314	41.8	25
26	Hupmobile-Eight....H	125	60¼	60 1/16	206 5/8	.....	6.50/16	4.54	8-3 1/16x4 3/4	L	II	CI	303.2	32.51	120–3600	.....	5.80	No	142	2000	.....	.....	.396	3292	.....	26
27	La Salle-V8....38-50	124	58	59	201	3830	7.00/16	3.92	8-3 5/16x4 1/2	L	V	CI	322.0	36.45	125–3400	234–1800	6.25	5.75	155	1000	11.88	30.6	.388	2740	40.7	27
28	Lincoln....V-12	136, 145	60	60	(t)	.....	7.50/17	4.58	12-3 1/16x4 1/2	L	V	Al	414.0	46.80	150–....	312–1200	6.38	.....	138	1000	.....	.....	.....	2982	.....	28
29	Lincoln-Zephyr.....	125	.....	.....	210	.....	7.00/16	4.44	12-2.75x3.75	L	V	Al	267.3	36.30	110–3800	.....	6.70	No	.....	.....	.....	.....	.....	3104	.....	29
30	Nash-Lafay-Mast. & Del....3810	117	58	60¼	182 7/8	(s)	6.00/16	4.11	6-3 5/16x4 5/8	L	II	CI	234.8	27.34	95–3400	175–1000	5.83	No	125	350	13.62	33.7	.405	3092	38.4	30
31	Nash-Amb. Six....3820	121	58	60¼	200 1/2	.....	6.25/16	4.11	6-3 5/16x4 5/8	I	II	CI	234.8	27.34	105–3400	190–1050	6.00	No	125	350	.....	.....	.447	3055	.....	31
32	Nash-Amb. Eight....3880	125	58	61 5/8	204 1/2	.....	7.00/16	4.10	8-3 1/16x4 1/4	I	II	CI	260.8	31.25	115–3400	200–1200	6.00	No	110	350	.....	.....	.442	2923	.....	32
33	Oldsmobile-Six....F-38	117	58	59	190 7/16	3285	6.50/16	4.37	6-3 7/16x4 1/8	L	II	CI	229.7	28.40	95–3400	180–1600	6.10	No	146	1000	14.32	34.6	.413	3168	38.4	33
34	Oldsmobile-Eight....L-38	124	58	59	197 1/8	3490	7.00/16	4.62	8-3 1/32x3 7/8	L	II	CI	257.1	33.80	110–3600	200–1800	6.20	No	152	1000	13.59	31.7	.428	3229	41.7	34
35	Packard-Six....1600	122	59 3/16	60	196 5/16	3525	6.50/16	4.54	6-3 1/32x4 1/4	L	II	CI	245.3	29.40	100–3600	.....	6.52	7.05	.....	.....	14.40	35.3	.408	3292	40.0	35
36	Packard-Eight....1601,2	127, 148	59 3/16	60	(b)	3650	7.00/16	(e)	8-3 1/32x4 1/4	L	II	Al	282.0	33.80	120–3800	.....	6.60	7.05	.....	.....	12.93	30.4	.425	3048	41.4	36
37	Packard-Super Eight....1603,4,5	127,34,39	59¼	61	(c)	4350	7.50/16	4.69	8-3 1/16x5	L	II	Al	320.0	32.50	130–3200	.....	6.50	7.05	.....	.....	13.60	33.4	.407	3170	41.6	37
38	Packard-Twelve....1606,7	134, 139	60¼	61	(d)	5525	8.25/16	4.41	12-3 7/16x4 1/4	ML	V	Al	473.0	56.50	175–3200	.....	6.40	(f)	.....	.....	11.68	31.6	.370	2933	45.3	38
39	Pierce Arrow....1801	138, 47	59 3/16	61½	(p)	5675	7.00/17	4.58	8-3 1/32x5	L	II	Al	385.0	39.20	150–3400	300–1600	6.40	No	148	2500	14.72	37.8	.390	3087	37.6	39
40	Pierce Arrow....1802	138,44,47	59½	61½	(q)	5920	7.50/17	4.58	12-3 1/32x4	L	V	Al	462.0	58.80	185–3400	350–1500	6.40	No	140	2500	12.80	32.0	.401	2982	42.0	40
41	Pierce Arrow....1803	138,44,47	59½	61½	223¾	6125	7.50/17	4.58	12-3 1/32x4	L	V	Al	462.0	58.80	185–3400	350–1500	6.40	No	140	2500	13.25	33.1	.401	2982	40.7	41
42	Plymouth....P-5	112	55 13/32	59 1/16	194 1/16	2774	5.50/16	3.90	6-3 1/32x4 1/8	L	II	CI°	201.3	23.44	82–3600	.....	6.70	7.00	145	1000	13.80	33.7	.408	2999	36.6	42
43	Plymouth....P-6	112	55 13/32	59 1/16	194 1/16	2834	6.00/16	4.10	6-3 1/32x4 1/8	L	II	CI°	201.3	23.44	82–3600	.....	6.70	7.00	145	1000	14.20	34.7	.408	3042	36.2	43
44	Pontiac-Six....38-26DA	117	58 3/16	59	192	3285	6.00/16	(g)	6-3 7/16x4	L	II	CI	222.7	28.3	85–3520	161–1600	6.20	No	141.5	1000	14.75	38.6	.382	3243	37.4	44
45	Pontiac-Eight....38-28DA	122	58 3/16	59	196 5/16	3420	6.50/16	(g)	8-3 1/4x3 3/4	L	II	CI	248.9	33.8	100–3700	172–1600	6.20	No	141.5	1000	13.75	34.2	.402	3168	40.0	45
46	Studebaker-Six & Com....7A-8A	116½	59½	59½	193¼	.....	6.00/16	4.55	6-3 1/16x4 3/8	L	II	CI	226.0	26.35	90–3400	174–1200	6.00	No	105	150	.....	.....	.398	3376	.....	46
47	Studebaker-President....4C	122	59½	59½	199¼	.....	6.50/16	4.55	8-3 1/16x4 1/4	L	II	CI	250.4	30.00	110–3600	195–2000	6.00	No	105	150	.....	.....	.440	3299	.....	47
48	Willys....38	100	55	56	178	.....	5.50/16	4.30	4-3 1/16x4 1/2	L	II	CI°	134.2	15.63	48–3200	100–1600	5.70	No	87	216	.....	.....	.358	3307	.....	48

Note—Not available for release by Oct. 23. Unofficially reported that Ford mechanical specifications will show few changes over 1937.

ABBREVIATIONS:

†—Computed on basis all tires are of same make, specified plies and standard rear axle ratio

††—Computed on basis of displacement, rear axle ratio, effective tire diameter and shipping weight with normal load (400 lbs.)

°—Others also

(a)—6.25 and 5.75

(b)—1601-200 1/32, 1602-221 1/32

(c)—1603-216 1/32, 1604-223 1/32, 1605-228 1/32

(d)—1607-223 1/32, 1608-228 1/32

(e)—1601-4.36, 1602-4.70

(f)—6.00, 7.00

(g)—Standard 4.375, Mountain 4.625, Plain 4.125

(h)—6.50, 7.40

(k)—84.5—197¾; 87-204¾

(m)—84-3155, 85-3195, 87-3270

(n)—900-2000 R.P.M.

(p)—138 W.B.-216, 144 W.B.-221

(q)—138 W.B.-216; 144 W.B.-220¾; 147 W. B.-223¾

(s)—Master 3200; Master De Luxe 3300

(t)—136 W.B.-213; 145 W.B.-222

Al—Aluminum
CI—Cast Iron
I—In-Head
II—In-Line
L—Ell-Head
ML—Modified Ell-Head
V—Vee-Type

PISTONS, RINGS, CONNECTING RODS

Line Numbers	CAR MAKE AND MODEL	Number of Cylinders, Bore and Stroke	PISTON: Make	Material	Features	Weight (Oz.) without rings, pin or bushing	Length (Inches)	Clearance (Inches) Average: Top Land	Clearance (Inches) Average: Bottom of Skirt	Number of Grooves	Ring Groove Depth (In.): Oil	Ring Groove Depth (In.): Compression	PISTON RINGS: OIL: Number Used	OIL: Width (In.)	OIL: Average Gap (In.)	OIL: Maximum Wall Thickness (In.)	Compression: Number Used	Compression: Width (In.)	Compression: Average Gap (In.)	Compression: Maximum Wall Thickness (In.)	WRIST PIN: Length (In.)	WRIST PIN: Diameter (In.)	WRIST PIN: Locked In	WRIST PIN: Clearance Average (In.)	CONNECTING RODS: Length (In.	CONNECTING RODS: Material	CONNECTING RODS: Weight (Oz.)	Line Numbers
1	Bantam 60	4-2.2x3.00	Bohn	Ala	Ss,St,C,T	.....	2 3/4	.010	.0005	3	.128	.128	1	1/8	.011	.....	2	1/32	.006	.....	2	11/32	R	.0002	5 1/4	1045	.....	1
2	Buick-Special 38-40	8-3 1/16x4 1/2	Own	Lx	Tt,Trs,C,An	14.56	4 9/32	.021	.0018*	4	.167	.150	2	1/16	.012	.140	2	1/8,3/32	.012	.150	2 1/16	.612	R	.00035	7 5/8	1045	29.92	2
3	Buick-Century 38-60	8-3 1/16x4 1/8	Own	Lx	Tt,Trs,C,An	17.71	4 7/16	.024	.0020*	4	.178	.165	2	1/16	.012	.150	2	1/8,3/32	.012	(m)	3 1/16	.874	R	.00035	8 1/4	1045	38.43	3
4	Buick-Roadmaster 38-80	8-3 1/16x4 1/8	Own	Lx	Tt,Trs,C,An	17.71	4 7/16	.024	.0020*	4	.178	.165	2	1/16	.012	.150	2	1/8,3/32	.012	(m)	3 1/16	.874	R	.00035	8 1/4	1045	38.43	4
5	Buick-Limited 38-90	8-3 1/16x4 1/8	Own	Lx	Tt,Trs,C,An	17.71	4 7/16	.024	.0020*	4	.178	.165	2	1/16	.012	.150	2	1/8,3/32	.012	(m)	3 1/16	.874	R	.00035	8 1/4	1045	38.43	5
6	Cadillac-V8 38-60	8-3 1/16x4 1/2	Ly,Bo	Lx,Ala	Ts,An	18.30	4 1/8	.....	.0021*	4	.153	.151	2	1/32	.011	.150	2	1/16	.0095	.150	3 1/16	7/8	F	(a)	8 3/4	1035	60.56	6
7	Cadillac-V8 38-65	8-3 1/16x4 1/2	Ly,Bo	Lx,Ala	Ts,An	18.30	4 1/8	.....	.0021*	4	.153	.151	2	1/32	.011	.150	2	1/16	.0095	.150	3 1/16	7/8	F	(a)	8 3/4	1035	60.56	7
8	Cadillac-V8 38-75	8-3 1/16x4 1/2	Ly,Bo	Lx,Ala	Ts,An	18.30	4 1/8	.....	.0021*	4	.153	.151	2	1/32	.011	.150	2	1/16	.0095	.150	3 1/16	7/8	F	(a)	8 3/4	1035	60.56	8
9	Cadillac-Sixteen 38-90	16-3 1/4x3 1/4	Ly,Bo	Lx,Ala	Ts,An	.....	3 3/4	.....	.....	3	.160	.159	1	3/16	.011	.145	2	1/4,3/32	.011	(b)	2 11/32	13/16	R	.00035	6 5/8	1340	.....	9
10	Chevrolet-Master	6-3 1/16x3 3/4	Own	Cl	Do,Sl,T	22.70	4 11/64	.0095	.0022	3	.178	.156	1	.186	.010	.155	2	.123	.010	.155	3.140	.864	R	SF	6 11/16	FS	28.30	10
11	Chevrolet-Master De Luxe	6-3 1/16x3 3/4	Own	Cl	Do,Sl,T	22.70	4 11/64	.0095	.0022	3	.178	.156	1	.186	.010	.155	2	.123	.010	.155	3.140	.864	R	SF	6 11/16	FS	28.30	11
12	Chrysler-Royal C-18	6-3 5/16x4 1/2	.....	Ala	Us,C,An	.....	3 7/8	.022	.0005	4	.177	.157	2	1/32	.011	.145	2	1/16	.011	.145	2 1/16	13/32	F	FP	7 7/8	MS	.....	12
13	Chrysler-Imperial C-19	8-3 1/16x4 1/2	.....	Ala	Us,C,An	.....	3 7/8	.021	.0005	4	.177	.157	2	1/32	.011	.145	2	1/16	.011	.145	2 1/4	13/32	F	FP	9 1/4	MS	.....	13
14	Chrysler-Cust. Imp C-20	8-3 1/4x4 1/8	.....	Ala	Us,C,An	.....	3 7/8	.021	.0005	4	.177	.157	2	1/32	.011	.145	2	1/16	.011	.145	2 1/4	13/32	F	FP	9.0	MS	.....	14
15	De Soto S-5	6-3 5/16x4 1/4	.....	Ala	Us,C,An	.....	3 7/8	.022	.0005	4	.177	.157	2	1/32	.011	.145	2	1/16	.011	.145	2 1/8	13/32	F	FP	8.0	MS	.....	15
16	Dodge D-8	6-3 1/4x4 3/8	.....	Ala	Ss,St	.....	3 11/16	.022	.1017	4	.177	.157	2	1/32	.011	.145	2	1/32	.011	.145	2 1/4	13/32	F	FP	7 11/16	MS	.....	16
17	Ford	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17
18	Ford	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18
19	Graham-Special	6-3 1/4x4 3/8	Bohn	Al	C,St,T	14.12	3 5/8	.012	.0025	4	.177	.157	2	(k)	.010	.....	2	1/32	.010	.....	2 11/16	11/16	R	.0005	7.0	FS	.....	19
20	Graham-Supercharger	6-3 1/4x4 3/8	Bohn	Al	C,St,T	14.12	3 5/8	.012	.0025	4	.177	.157	2	(k)	.010	.....	2	1/32	.010	.....	2 11/16	11/16	R	.0005	7.0	FS	.....	20
21	Hudson-Terraplane 81	6-3x5	Own	Lx,Ala	C	10.50	3.187	.016	.0007	4	.187	.093	2	.187	.010	.128	2	.093	.010	.123	2.437	.750	F	.0003	8.187	FS	31.36	21
22	Hudson-Terraplane 82	6-3x5	Own	Lx,Ala	C	10.50	3.187	.016	.0007	4	.187	.093	2	.187	.010	.128	2	.093	.010	.123	2.437	.750	F	.0003	8.187	FS	31.36	22
23	Hudson-Six 83	6-3x5	Own	Lx,Ala	C	10.50	3.187	.016	.0007	4	.187	.093	2	.187	.010	.128	2	.093	.010	.123	2.437	.750	F	.0003	8.187	FS	31.36	23
24	Hudson-Eight 84,5,7	8-3x4	Own	Lx,Ala	C	10.88	3.187	.016	.0007	4	.187	.093	2	.187	.010	.128	2	.093	.010	.123	2.437	.750	F	.0003	8.187	FS	31.00	24
25	Hupmobile-Six ..... E	6-3 1/16x4 1/4	Bohn	Ala	St	.....	.....	.....	.....	4	.....	.....	2	1/8	.....	.....	2	1/32	.....	.....	.....	7/8	.....	.....	8 1/4	FS	.....	25
26	Hupmobile-Eight ..... H	8-3 7/16x4 3/4	Bohn	Ala	St	.....	.....	.....	.....	4	.....	.....	2	1/8	.....	.....	2	1/32	.....	.....	.....	7/8	.....	.....	9 1/8	FS	.....	26
27	La Salle-V8 38-50	8-3 5/16x4 1/2	Ly,Bo	Lx,Ala	Ts,An	16.88	4 1/8	.023	.0013	4	.154	.152	2	1/32	.011	.145	2	1/16	.0095	.145	2 1/16	7/8	F	(a)	8 3/4	1035	60.56	27
28	Lincoln V-12	12-3 1/16x4 1/2	Own	Ala	O	12.50	3.87	.....	.....	4	.166	(p)	2	.154	.011	.140	2	.124	.011	.125	3.00	6.75	P	.0005	10.87	FS	38.00	28
29	Lincoln-Zephyr	12-2.75x3.75	Own	CSA	.....	11.50	2.97	.....	.....	3	.145	.145	1	.155	.010	.125	2	.093	.010	.125	2.48	7.50	F	.0005	7.40	FS	22.50	29
30	Nash-Lafay-Mast. & DeL ... 3810	6-3 5/16x4 3/8	Bohn	Ala	Ss,St	19.12	3 7/8	.022	.0015	4	.....	.....	2	1/32	.....	.....	2	1/8	.....	.....	.....	7/8	F	.0001	8 3/4	FS	36.25	30
31	Nash-Amb. Six 3820	6-3 5/16x4 3/8	Bohn	Ala	Ss,St	19.50	3 7/8	.022	.0015	4	.188	.168	2	1/32	.....	.....	2	1/8	.....	.....	.....	7/8	F	.0001	8 3/4	FS	36.25	31
32	Nash-Amb. Eight 3880	8-3 5/16x4 1/4	Bohn	Ala	Ss,St	16.00	.....	.020	.0015	4	.182	.162	2	.....	.....	.....	2	.....	.....	.....	.....	7/8	F	.0001	8 3/4	FS	34.00	32
33	Oldsmobile-Six F-38	6-3 7/16x4 1/8	Own	Al	Ts,O	17.00	4 3/32	.026	.0015	4	.171	.156	2	1/16	.011	.150	2	1/8	.0105	.153	3 1/16	13/32	P	.0004	7 11/16	1335-A	26.25	33
34	Oldsmobile-Eight L-38	8-3 1/4x3 7/8	Own	Al	Ss,O	16.04	3 11/16	.026	.0015	4	.156	.140	2	1/16	.011	.150	2	1/8	.0115	.150	11/16	13/32	P	.0004	7 11/16	1335-A	28.00	34
35	Packard-Six 1600	6-3 1/16x4 1/4	.....	Ala	A,St	19.50	3 7/8	.....	.0015	3	(c)	.1835	1	.186	.011	.126	2	.124	.011	.145	3 1/16	7/8	F	FP	7 11/16	FS	31.60	35
36	Packard-Eight 1601,2	8-3 1/4x4 1/4	.....	Ala	A,St	16.87	3 7/8	.....	.0015	3	(d)	.1787	1	.186	.011	.125	2	.124	.011	.140	2 11/16	7/8	F	FP	7 11/16	FS	31.60	36
37	Packard-Super Eight 1603,4,5	8-3 1/16x5	.....	Ala	A,St	17.75	4 1/4	.....	.0015	4	(e)	(e)	2	.155	.011	(f)	2	.123	.011	(h)	2 11/16	7/8	F	FP	10 1/8	FS	40.30	37
38	Packard-Twelve 1606,7	12-3 7/16x4 1/4	.....	Ala	A,St	20.00	4.31	.....	.0015	4	.1652	.1652	1	.155	.011	(g)	2	.123	.011	(m)	2 11/16	7/8	F	FP	9.0	FS	36.00	38
39	Pierce Arrow 1801	8-3 1/16x5	Alcoa	Ly-132	Ts,An	.....	4 1/4	.035	.0020	4	.188	.168	2	.154	.017	.150	2	.123	.022	.150	3.031	.875	F	.0005	8.99	4140	34.82	39
40	Pierce Arrow 1802	12-3 1/16x4	Alcoa	Ly-132	Ts,An	.....	4 1/4	.035	.0020	4	.188	.168	2	.154	.017	.150	2	.123	.022	(n)	3.035	.875	F	.0005	9.63	4140	35.62	40
41	Pierce Arrow 1803	12-3 1/16x4	Alcoa	Ly-132	Ts,An	.....	4 1/4	.035	.0020	4	.188	.168	2	.154	.017	.150	2	.123	.022	(n)	3.035	.875	F	.0005	9.63	4140	35.62	41
42	Plymouth P-5	6-3 1/16x4 3/8	.....	Ala	Us,C,An	.....	3 11/16	.021	.0007	4	.171	.151	2	1/32	.011	.140	2	1/16	.011	.140	2 5/16	11/16	F	FP	7 11/16	MS	.....	42
43	Plymouth P-6	6-3 1/16x4 3/8	.....	Ala	Us,C,An	.....	3 11/16	.021	.0007	4	.171	.151	2	1/32	.011	.140	2	1/16	.011	.140	2 5/16	11/16	F	FP	7 11/16	MS	.....	43
44	Pontiac-Six 38-26DA	6-3 7/16x4	Own	CNI	T	26.68	3 27/32	.023	.002	3	.188	.158	1	.1862	.012	.150	2	.1237	.012	.150	3 1/16	13/32	P	.0004	7 1/16	FS	32.00	44
45	Pontiac-Eight 38-28DA	8-3 1/16x3 3/4	Own	CNI	T	24.25	3 11/16	.023	.002	3	.188	.158	1	.1862	.012	.150	2	.1237	.012	.150	2 1/16	13/32	P	.0004	7 1/16	FS	31.75	45
46	Studebaker-Six & Com.... 7A-8A	6-3 1/16x4 3/8	Alcoa	Ly-132	Ts,C	.....	3 5/8	.0175	.015	3	.1875	.1505	1	3/16	.017	.145	2	1/16	.0155	.145	2 1/16	5/8	R	.0002	8 1/8	FS	33.20	46
47	Studebaker-President 4C	8-3 7/16x4 1/4	Alcoa	LyA132	Ts,C	.....	3 3/4	.017	.0015	3	.1755	.140	1	1/16	.017	.125	2	1/16	.0155	.135	2 1/16	5/8	R	.0002	8.0	FS	32.00	47
48	Willys 38	4-3 1/16x4 1/8	Own	Cl	Sp,St,C,T,O	22.0	3 3/4	.016	.0027	4	.1665	.1485	1	1/16	.0105	.103	3	1/32	.0105	.140	2.68	11/16	F	.0003	9 1/16	1035	34.00	48

ABBREVIATIONS:

•—At top of skirt
(a)—One end .0004 press fit, other end .0000 clearance
(b)—1/16—.145, 3/32—.162
(c)—Top .161, second .1835
(d)—Top .156, second .1787
(e)—Top .15325, second & third .1732, fourth .1545
(f)—Upper .140; Lower .122
(g)—Upper .150; Lower .132
(h)—Upper .145; Lower .140
(k)—Upper 1/16; Lower 1/32
(m)—Upper .155; Lower .150
(n)—Stepcut .150; Plain .145
(p)—Top ring .147; Second ring. 145
A—Autothermic
Al—Aluminum
Ala—Aluminum alloy
Alcoa—Aluminum Co. of America
An—Anodized finish
Bohn—Nelson-Bohnalite
C—Cam Ground
Cl—Cast Iron
CNI—Chrome Nickel Iron
CSA—Cast Steel Alloy
Do—Dome Head
F—Floating FP—Finger Pushfit
FS—Forged Steel
Lx—LoEx Aluminum
Ly—Lymite
Ly, Bo—Lymite or Bohn
MS—Manganese Steel
O—Oxidized finish
P—Piston R—Rod
SF—Slip Fit
Sl—Slipper Type Ski
Ss—Split Skirt
St—Strut Type
T—Tin Plated
Trs—Tri Slot
Ts—Tee Slot Us—"U"-Slot

CONNECTING ROD AND CRANKSHAFT BEARINGS

Line Number	CAR MAKE AND MODEL	CONNECTING ROD BEARINGS								CRANKSHAFT BEARINGS								DIAMETER AND LENGTH (Inches)								Line Number
		Diameter and Length (In.)	Material	Make	Average Clearance (In.)	Average End Play (In.)	Type of Shim	Type of Bearing	Rods and Pistons Removed from	Vibration Damper?	Crankshaft Counterweights	End Thrust Taken By	Amount of End Play (In.)	Main Bearing Material	Average Bearing Clearance (In.)	Type of Bearing	Type of Shim	No. 1	No. 2	No. 3	No. 4	No. 5	No. 6	No. 7	No. 8	No. 9	
1	Bantam.....60	1⅛x1¼	Bab	Own	.0015	.0065	....	Sp	A	No	3	R	.0045	Bab	.0020	....	....	2½x1	2½x1	.....	.....	.....	.....	.....	.....	.....	1
2	Buick-Special.....38-40	2x1.21	B-Sp	Own	.0013	.0075	So	Sp	A	Yes	8	C	.006	BSb	.0014	Se	So	2⅛x1⅛	2⅛x1⅛	2⅛x1⅝	2⅛x2⅛	.....	.....	.....	.....	.....	2
3	Buick-Century.....38-60	2¼x1.30	B-Sp	Own	.0013	.0075	So	Sp	A	Yes	8	C	.006	BSb	.0014	Se	So	2⅛x1⅛	2⅛x1⅛	2⅛x1⅝	2⅛x2⅛	.....	.....	.....	.....	.....	3
4	Buick-Roadmaster.....38-80	2¼x1.30	B-Sp	Own	.0013	.0075	So	Sp	A	Yes	8	C	.006	BSb	.0014	Se	So	2⅛x1⅛	2⅛x1⅛	2⅛x1⅝	2⅛x2⅛	.....	.....	.....	.....	.....	4
5	Buick-Limited.....38-90	2¼x1.30	B-Sp	Own	.0013	.0075	So	Sp	A	Yes	8	C	.006	BSb	.0014	Se	So	2⅛x1⅛	2⅛x1⅛	2⅛x1⅝	2⅛x2⅛	.....	.....	.....	.....	.....	5
6	Cadillac-V8.....38-60	2.46x2 7/16	BSb	.....	.0015	.0045	No	Se	A	Two	6	C	.0030	BBSb	.0015	Sl	No	2½x1⅛	2½x1⅛	2½x1⅜	.....	.....	.....	.....	.....	.....	6
7	Cadillac-V8.....38-65	2.46x2 7/16	BSb	.....	.0015	.0045	No	Se	A	Two	6	C	.0030	BBSb	.0015	Sl	No	2½x1⅛	2½x1⅛	2½x1⅜	.....	.....	.....	.....	.....	.....	7
8	Cadillac-V8.....38-75	2.46x2 7/16	BSb	.....	.0015	.0045	No	Se	A	Two	6	C	.0030	BBSb	.0015	Sl	No	2½x1⅛	2½x1⅛	2½x1⅜	.....	.....	.....	.....	.....	.....	8
9	Cadillac-Sixteen.....38-90	2.00x1¾	BSb	.....	.0015	.0060	No	Se	A	Yes	8	5	.....	BSb	.0015	Sl	No	2½x1⅛	2½x1⅛	2½x1⅛	2½x1⅛	2½x1⅛	2½x1⅛	2½x1⅛	2½x1⅛	2½x2 7/16	9
10	Chevrolet-Master.....	2⅛x1½	Bab	Own	.0017	.010	So	Sp	A	Yes	7	3	.0055	BSb	.0030	Sl	So	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x1⅝	.....	.....	.....	.....	.....	10
11	Chevrolet-Master De Luxe.....	2⅛x1½	Bab	Own	.0017	.010	So	Sp	A	Yes	7	3	.0055	BSb	.0030	Sl	So	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x1⅝	.....	.....	.....	.....	.....	11
12	Chrysler-Royal.....C-18	2⅛x1⅛	BSb	.....	.0015	.0085	No	Se	A	Yes	9	R	.0050	BSb	.0015	Sl	No	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x1⅞	.....	.....	.....	.....	.....	12
13	Chrysler-Imperial.....C-19	2⅛x1⅛	BSb	.....	.0015	.0085	No	Se	A	Yes	8	R	.0050	BSb	.0015	Sl	No	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x2⅛	.....	.....	.....	.....	.....	13
14	Chrysler-Cust. Imp.....C-20	2⅛x1⅛	BSb	.....	.0015	.0085	No	Se	A	Yes	8	R	.0050	BSb	.0010	Sl	No	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x2⅛	.....	.....	.....	.....	.....	14
15	De Soto.....S-5	2½x1⅞	BSb	.....	.0015	.0085	No	Se	A	Yes	7	R	.0050	BSb	.0015	Sl	No	2½x1⅛	2½x1⅛	2½x1⅛	2½x1⅞	.....	.....	.....	.....	.....	15
16	Dodge.....D-8	2⅛x1.00	BSb	.....	.0015	.0085	No	Se	A	Yes	7	R	.0050	BSb	.0015	Sl	No	2½x1⅛	2½x1⅛	2½x1⅛	2½x1⅝	.....	.....	.....	.....	.....	16
17	Ford.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	17
18	Ford.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	18
19	Graham-Special.....	2⅛x1⅛	CS-Sb	.....	.0020	.0050	No	Se	A	Lan	9	F	.0050	CS-Sb	.0020	Sl	No	2½x1⅛	2½x1½	2½x1½	2½x1⅛	.....	.....	.....	.....	.....	19
20	Graham-Supercharger.....	2⅛x1⅛	CS-Sb	.....	.0020	.0050	No	Se	A	Lan	9	F	.0050	CS-Sb	.0020	Sl	No	2½x1⅛	2½x1½	2½x1½	2½x1⅛	.....	.....	.....	.....	.....	20
21	Hudson-Terraplane.....81	1.937x1.395	B-Sp	Own	.0004	.0080	So	Sp	A	Yes	8	C	.0090	BBb	.0010	In	Lam	2.343x1.625	2.375x1.750	2.406x2.375	.....	.....	.....	.....	.....	.....	21
22	Hudson-Terraplane.....82	1.937x1.395	B-Sp	Own	.0004	.0080	So	Sp	A	Yes	8	C	.0090	BBb	.0010	In	Lam	2.343x1.625	2.375x1.750	2.406x2.375	.....	.....	.....	.....	.....	.....	22
23	Hudson-Terraplane.....83	1.937x1.395	B-Sp	Own	.0004	.0080	So	Sp	A	Yes	8	C	.0090	BBb	.0010	In	Lam	2.343x1.625	2.375x1.750	2.406x2.375	.....	.....	.....	.....	.....	.....	23
24	Hudson-Six.....84,5,7	1.937x1.375	B-Sp	Own	.0004	.0080	So	Sp	A	Yes	8	C	.0090	BBb	.0010	In	Lam	2.281x1.625	2.312x1.375	2.343x1.875	2.375x1.375	2.406x2.00	.....	.....	.....	.....	24
25	Hudson-Eight.....E	2⅛x1¼	BSb	.....	.....	.....	No	Se	....	Yes	Yes	.....	.....	BSb	.....	Sl	No	2.561x1⅝	2.561x1⅞	2.561x1¼	2.561x2⅛	.....	.....	.....	.....	.....	25
26	Hupmobile-Six.....H	2⅛x1¼	BSb	.....	.....	.....	No	Se	....	Yes	Yes	.....	.....	BSb	.....	Sl	No	2.665x1⅞	2.665x1¼	2.665x1½	2.665x1¼	2.665x2¼	.....	.....	.....	.....	26
27	La Salle-V8.....38-50	2.46x2 7/16	BSb	.....	.0015	.0045	No	Se	A	No	6	C	.003	BBSb	.0015	Sl	No	2½x1⅛	2½x1⅛	2½x1⅜	.....	.....	.....	.....	.....	.....	27
28	Lincoln.....V-12	2¼x2	CLSb	.....	.....	.....	No	Se	B	Yes	.....	4	.....	CL-Sb*	.....	.....	No	2½x1⅝	2½x1⅝	2½x1⅝	2½x3½	.....	.....	.....	.....	.....	28
29	Lincoln-Zephyr.....	2.12x7.87	BSb	.....	.....	.....	No	Se	A	Yes	.....	R	.....	BSb	.....	.....	.....	2.40x1.839	2.40x1.375	2.40x1.375	2.40x2.254	.....	.....	.....	.....	.....	29
30	Lincoln-Zephyr.....	2.00x1.425	BSb	CGB	.0020	.0010	No	Se	A	Yes	4	C	.004	BSb	.0020	Sl	No	2⅛x1¼	2⅛x1⅛	2⅛x1⅛	2⅛x1⅞	2⅛x1⅛	2⅛x1⅛	.....	.....	.....	30
31	Nash-Lafay-Mast. & M. DeL3810	2.00x1.425	BSb	CGB	.0020	.0010	No	Se	A	Yes	4	C	.004	BSb	.0020	Sl	No	2⅛x1¼	2⅛x1⅛	2⅛x1⅛	2⅛x1⅝	2⅛x1⅛	2⅛x1⅛	.....	.....	.....	31
32	Nash-Amb. Six.....3820	2.00x1.425	BSb	CGB	.0020	.0010	No	Se	B	Yes	No	C	.004	BSb	.0020	Sl	No	2⅛x1½	2⅛x1⅛	2⅛x1⅛	2⅛x1⅞	2⅛x1⅝	2⅛x1⅛	2⅛x1⅛	2⅛x2 7/16	.....	32
33	Nash-Amb. Eight.....3880	2.00x1.24	BSb	CGB	.0020	.0010	No	Se	B	Yes	No	C	.004	BSb	.0020	Sl	No	2⅛x1½	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x1⅝	2⅛x1⅛	2⅛x1⅛	2⅛x2 7/16	.....	33
34	Oldsmobile-Six.....F-38	2⅛x1⅜	BSb	Own	.0020	.0080	No	Se	A	Yes	7	F	.006	BSb	.0020	Sl	No	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	.....	.....	.....	.....	.....	34
35	Oldsmobile-Eight.....L-38	2⅛x1⅜	BSb	Own	.0020	.0080	No	Se	A	Yes	8	F	.006	BSb	.0020	Sl	No	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	.....	.....	.....	.....	35
36	Packard-Six.....1600	2⅜x1¼	Bab	.....	.0010	.0070	No	Se	....	Yes	6	1	.0055	BSb	.0020	....	No	2⅝x1⅛	2⅝x1⅛	2⅝x1⅛	2⅝x2⅛	.....	.....	.....	.....	.....	36
37	Packard-Eight.....1601,2	2⅜x1¼	Bab	.....	.0010	.0070	No	Se	....	Yes	8	C	.0055	BSb	.0020	....	No	2⅝x1½	2⅝x1⅛	2⅝x1⅛	2⅝x1⅞	2⅝x2⅛	.....	.....	.....	.....	37
38	Packard-Super Eight....1603,4,5	2⅛x1⅛	Cla	.....	.0012	.0040	No	Se	....	Yes	8	7	.0040	BSb	.0020	....	No	2⅝x2	2⅝x1⅛	2⅝x1⅛	2⅝x1⅞	2⅝x1⅝	2⅝x1⅛	2⅝x1⅛	2⅝x2⅛	.....	38
39	Packard-Twelve.....1606,7	2½x1⅜	Cla	.....	.0012	.0090	No	Se	....	Yes	6	1	.0040	BSb	.0020	....	No	2¾x2¼	2¾x1⅝	2¾x1⅝	2⅝x1⅞	2⅝x1⅝	2⅝x1⅝	2⅝x1⅝	2⅝x2⅛	.....	39
40	Pierce Arrow.....1801	2.25x1.25	B-Sp	.....	.0017	.0050	No	Sp	A	Yes	16	F	.0030	BBb	.0022	Sl	No	2⅝x1¾	2⅝x1⅝	2⅝x1⅝	2⅝x1⅞	2⅝x1¾	2⅝x1¾	2⅝x1¾	2⅝x1¾	.....	40
41	Pierce Arrow.....1802	2.12x1.12	B-Sp	.....	.0017	.0075	No	Sp	A	Yes	12	F	.0030	BBb	.0022	Sl	No	2⅝x1¾	2⅝x1¼	2⅝x1¼	2⅝x1⅞	2⅝x1¼	2⅝x1¼	2⅝x3.47	.....	.....	41
42	Pierce Arrow.....1803	2.12x1.12	B-Sp	.....	.0017	.0075	No	Sp	A	Yes	12	F	.0030	BBb	.0022	Sl	No	2⅝x1¾	2⅝x1¼	2⅝x1¼	2⅝x1⅞	2⅝x1¼	2⅝x1¼	2⅝x3.47	.....	.....	42
43	Plymouth.....P-5	1⅛x1	BSb	.....	.0015	.0085	No	Se	A	No	7	R	.0050	BSb	.0015	Sl	No	2¼x1⅛	2¼x1⅛	2¼x1⅛	2¼x1⅞	.....	.....	.....	.....	.....	43
44	Plymouth.....P-6	1⅛x1	BSb	.....	.0015	.0085	No	Se	A	No	7	R	.0050	BSb	.0015	Sl	No	2¼x1⅛	2¼x1⅛	2¼x1⅛	2¼x1⅞	.....	.....	.....	.....	.....	44
45	Pontiac-Six.....38-26DA	2x1⅛	SBW	Own	.0010	.0075	No	Se	A	Yes	7	RC	.0055	SBW	.002	Sl	No	2⅝x1⅛	2⅛x1⅝	2⅛x1⅝	2⅛x2	.....	.....	.....	.....	.....	45
46	Pontiac-Eight.....38-28DA	2x1⅛	SBW	Own	.0010	.0075	No	Se	A	Yes	8	RC	.0055	SBW	.002	Sl	No	2⅝x1⅛	2⅛x1⅝	2⅛x1⅝	2⅛x1⅞	2⅛x2	.....	.....	.....	.....	46
47	Studebaker-Six & Com....7A-8A	2⅛x1⅜	B-Sp	Own	.0012	.0070	No	Sp	A	Yes	5	1	.0045	BSb	.0015	Sl	No	2⅝x1⅛	2⅝x1⅜	2⅝x1⅜	2⅝x1⅞	2⅛x2	.....	.....	.....	.....	47
48	Studebaker-President.....4C	1⅞x1⅛	Cle	CGB	.0017	.0075	No	Se	A	Yes	12	1	.0045	BSb	.0020	Sl	No	2⅛x1	2⅛x1⅛	2⅛x1⅛	2⅛x1⅞	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	2⅛x1⅛	48
48	Willys.....38	1⅛x1⅛	B-Sp	Own	.0010	.0065	No	Sp	A	No	No	1	.005	BSb	.0017	Sl	No	2.334x2.0	2.334x2.0	2.334x1⅛	.....	.....	.....	.....	.....	.....	48

ABBREVIATIONS:

*—Rear Only-Babbitt Steel Backed
A—Above
B—Below
Bab—Babbitt
BBb—Babbitt ,Bronze Backed
BBSb—Babbitt-Steel or Bronze Backed
BSb—Babbitt-Steel Backed
B-Sp—Babbitt-Spun
C—Center bearing
CGB—Cleveland Graphite Bronze Co.
Cla—Copper Lead Alloy
Cle—Clevite
CL-Sb—Copper Lead Alloy-Steel Backed
CS-Sb—Cadmium Silver-Steel Backed
F—Front
In—Integral with cap and base
Lam—Laminated
Lan—Lanchester
R—Rear bearing
RC—Rear Center
SBW—Steel Backed-White bearing metal alloy
Se—Separate
Sl—Slip in type
So—Solid
Sp—Spun

VALVES, INTAKE AND EXHAUST

Line Number	CAR MAKE AND MODEL	Arrangement	Make	INTAKE VALVE: Head Material	Head Diameter (In.)	Seat Angle (Deg.)	Stem Material	Stem Length (In.)	Stem Diameter (In.)	Stem End Style	Stem to Guide Clearance (In.) Average	Lift (In.)	Springs: Valve Open Pressure (Average)	Valve Open Length (In.)	Valve Closed Pressure (Average)	Valve Closed Length (In.)	Free Length (In.)	EXHAUST VALVE: Make	Head Material	Head Diameter (In.)	Seat Angle (Deg.)	Seat an Insert?	Stem Material	Stem Length (In.)	Stem Diameter (In.)	Stem End Style	Stem to Guide Clearance (In.) (Average)	Lift (In.)	Springs: Valve Open Pressure (Average)	Valve Open Length (In.)	Valve Closed Pressure (Average)	Valve Closed Length (In.)	Free Length	Line Number
1	Bantam 60	L		CNS	1 3/32	30	3140	3 1/4	.279	W	.0022	.257	.....	1	23	1 1/4	1 11/16	.....	SiC	1 3/32	30	No	3140	3 1/4	.279	W	.0022	.257	.....	1	23	1 1/4	1 11/16	1
2	Buick-Special 38-40	I	Tmp	(b)	1 13/32	45	(b)	4 1/16	.372	SC	.0025	.348	118†	(c)	47†	(d)	(e)	TR	(f)	1 13/32	45	No	(f)	4 1/16	.3715	SC	.0030	.342	118†	(c)	47†	(d)	(e)	2
3	Buick-Century 38-60	I	Tmp	(b)	1 13/32	45	(b)	4 1/16	.372	SC	.0025	.347	118†	(c)	47†	(d)	(e)	TR	(f)	1 7/16	45	No	(f)	4 1/16	.3715	SC	.0030	.348	118†	(c)	47†	(d)	(e)	3
4	Buick-Roadmaster 38-80	I	Tmp	(b)	1 13/32	45	(b)	4 1/16	.372	SC	.0025	.347	118†	(c)	47†	(d)	(e)	TR	(f)	1 7/16	45	No	(f)	4 1/16	.3715	SC	.0030	.348	118†	(c)	47†	(d)	(e)	4
5	Buick-Limited 38-90	I	Tmp	(b)	1 13/32	45	(b)	4 1/16	.372	SC	.0025	.347	118†	(c)	47†	(d)	(e)	TR	(f)	1 7/16	45	No	(f)	4 1/16	.3715	SC	.0030	.348	118†	(c)	47†	(d)	(e)	5
6	Cadillac-V8 38-60	L	.....	3140	1.881	45	3140	5 1/32	.342	DGS	.0023	.335	145	1.581	66	1.926	2.210	WR	SII-10	1.631	45	No	(a)	5 1/32	.341	DGS	.0033	.345	145	1.581	66	1.926	2.210	6
7	Cadillac-V8 38-65	L	.....	3140	1.881	45	3140	5 1/32	.342	DGS	.0023	.335	145	1.581	66	1.926	2.210	WR	SII-10	1.631	45	No	(a)	5 1/32	.341	DGS	.0033	.345	145	1.581	66	1.926	2.210	7
8	Cadillac-V8 38-75	L	.....	3140	1.881	45	3140	5 1/32	.342	DGS	.0023	.335	145	1.581	66	1.926	2.210	WR	SII-10	1.631	45	No	(a)	5 1/32	.341	DGS	.0033	.345	145	1.581	66	1.926	2.210	8
9	Cadillac-Sixteen 38-90	L	.....	3140	1.500	45	3140	5 1/32	.342	DGS	.0023	.290	93.5	1.522	49	1.812	2.130	.....	82120	1.375	45	No	(a)	5 1/32	.341	DGS	.0033	.302	95.5	1.510	49	1.812	2.130	9
10	Chevrolet-Master	I	Own	Ext	1 3/32	30	Ext	6 1/16	.341	G	.0020	.305	115	1 1/16	45	1 7/8	2 3/32	Own	Ext	1 1/32	30	No	Ext	4 11/32	.341	G	.0030	.319	115	1 1/16	45	1 7/8	2 3/32	10
11	Chevrolet-Master De Luxe	I	Own	Ext	1 3/32	30	Ext	6 1/16	.341	G	.0020	.305	115	1 1/16	45	1 7/8	2 3/32	Own	Ext	1 1/32	30	No	Ext	4 11/32	.341	G	.0030	.319	115	1 1/16	45	1 7/8	2 3/32	11
12	Chrysler-Royal C-18	L	.....	CNS	1 3/32	45	CNS	4 31/32	.3405	G	.0020	.343	105	1 1/32	42 1/2	1 3/4	.....	.....	SII-10	1 1/32	45	Yes	SII-10	4 31/32	.3405	G	.0020	.343	105	.....	42 1/2	.....	.....	12
13	Chrysler-Imperial C-19	L	.....	CNS	1 1/16	45	CNS	5 1/32	.3405	G	.0020	.343	107	.....	48	.....	.....	.....	SII-10	1 1/32	45	Yes	SII-10	5 1/32	.3405	G	.0020	.343	107	.....	48	.....	.....	13
14	Chrysler-Cust. Imp C-20	L	.....	CNS	1 1/16	45	CNS	5 1/32	.3405	G	.0020	.343	107	1 1/16	48	2 3/32	.....	.....	SII-10	1 1/32	45	Yes	SII-10	5 1/32	.3405	G	.0020	.343	107	.....	48	.....	.....	14
15	De Soto S-5	L	.....	CNS	1 3/32	45	CNS	4 31/32	.3405	G	.0020	.343	105	.....	42 1/2	.....	.....	.....	SII-10	1 1/32	45	Yes	SII-10	4 31/32	.3405	G	.0020	.343	105	.....	42 1/2	.....	.....	15
16	Dodge D-8	L	.....	CNS	1 1/16	45	CNS	4 31/32	.3405	G	.0020	.312	80	.....	36	.....	.....	.....	SII-1	1 1/32	45	Yes	SII-1	4 31/32	.3405	G	.0040	.312	80	.....	36	.....	.....	16
17	Ford																																	17
18	Ford																																	18
19	Graham-Special	L	.....	CNS	1 3/32	30	CNS	4 7/8	.312	D	.0020	.312	87	.....	34	.....	.....	Tmp	XCR	1 3/32	45	No	XCR	4 7/8	.312	D	.0030	.312	87	.....	34	.....	.....	19
20	Graham-Supercharger	L	.....	CNS	1 3/32	30	CNS	4 7/8	.312	D	.0020	.312	87	.....	34	.....	.....	Tmp	XCR	1 3/32	45	No	XCR	4 7/8	.312	D	.0030	.312	87	.....	34	.....	.....	20
21	Hudson-Terraplane 81	L	WR	3140	1.375	45	3140	5.343	.343	HS	.0022	.343	102	1.656	44	2.00	2.26	WR	XB	1.375	45	No	SiC	5.343	.343	HS	.0040	.343	102	1.656	44	2.00	2.26	21
22	Hudson-Terraplane 82	L	WR	3140	1.375	45	3140	5.343	.343	HS	.0022	.343	102	1.656	44	2.00	2.26	WR	XB	1.375	45	No	SiC	5.343	.343	HS	.0040	.343	102	1.656	44	2.00	2.26	22
23	Hudson-Six 83	L	WR	3140	1.375	45	3140	5.343	.343	HS	.0022	.343	102	1.656	44	2.00	2.26	WR	XB	1.375	45	No	SiC	5.343	.343	HS	.0040	.343	102	1.656	44	2.00	2.26	23
24	Hudson-Eight 84,5,7	L	WR	3140	1.500	45	3140	5.093	.343	HS	.0022	.343	102	1.656	44	2.00	2.26	WR	XB	1.375	45	No	SII-1	5.093	.343	HS	.0040	.343	102	1.656	44	2.00	2.26	24
25	Hupmobile-Six E	L	.....	CNS	1 1/32	45	CNS	.....	.341		.....	.343	.....	.....	.....	.....	.....	.....	CT	1 1/32	45	.....	CNS	.....	.341		.....	.343	.....	.....	.....	.....	.....	.....	25
26	Hupmobile-Eight H	L	.....	CNS	1 1/32	45	CNS	.....	.341		.....	.325	.....	.....	.....	.....	.....	.....	CT	1 1/32	45	.....	CNS	.....	.341		.....	.325	.....	.....	.....	.....	.....	.....	26
27	La Salle-V8 38-50	L	.....	.....	1.881	45	3140	5 1/32	.342	DGS	.0023	.335	145	1.581	66	1.926	2.210	WR		1.631	45	No	(a)	5 1/32	.341	DGS	.0033	.345	145	1.581	66	1.926	2.210	27
28	Lincoln V-12	L	.....	3140	1 1/32	45	.....	.....	7/16		.004	11/32	.....	.....	.....	.....	.....	.....	SII-10	1 1/32	45	Yes	SII-10	.....	7/16		.004	11/32	.....	.....	.....	.....	.....	.....	28
29	Lincoln-Zephyr	L	.....	CNS	1.531	45	.....	.....	.....	CNS	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.531	45	Yes	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	29
30	Lincoln-Zephyr	L	.....	CNS	1.531	45	.....	.....	.....	CNS	.....	.....	.....	.....	.....	.....	.....	.....	.....	1.531	45	Yes	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	2 3/32	(g)	30
31	Nash-Lafay-Mast. & DeL 3810	L	AI-R	CNS	1 3/32	45	CNS	.....	.3402	G	.003	.312	.....	.....	.....	.....	2 3/32	AI-R	CN-Si	1 3/32	45	No	CN-Si	5 1/32	.3402	G	.0030	.312	.....	.....	.....	.....	(g)	(g)	31
32	Nash-Amb. Six 3820	I	WR	CNS	1.75	45	CNS	.....	.3725	G	.003	11/32	.....	.....	.....	.....	(g)	WR	CN-Si	1.593	45	No	CN-Si	5.45	.3725	G	.0030	11/32	.....	.....	.....	.....	(g)	(g)	32
33	Nash-Amb. Eight 3860	I	WR	3140	1.66	45	3140	.....	.375	G	.003	11/32	.....	.....	.....	.....	(g)	WR	CN-Si	1.468	45	No	CN-Si	.....	.375	G	.0030	11/32	.....	.....	.....	.....	.....	.....	33
34	Oldsmobile-Six F-38	L	Tmp	3140	1 1/16	30	3140	5 11/32	.343	SC	.0022	.....	94	1 1/32	46	2 3/32	2 5/8	Tmp	SII-10	1 3/32	45	No	SX	5 11/32	.343	SC	.0032	.....	94	1 1/32	46	2 3/32	2 5/8	34
35	Oldsmobile-Eight L-38	L	Tmp	3140	1 1/16	30	3140	5 11/32	.343	SC	.0022	.....	94	1 1/32	46	2 3/32	2 5/8	Tmp	SII-10	1 3/32	45	No	SX	5 11/32	.343	SC	.0032	.....	94	1 1/32	46	2 3/32	2 5/8	35
36	Packard-Six 1600	L	WR	CNS	1.575	30	CNS	5 5/16	.3402	SK	.002	.317	120	.....	50	1 5/8	.....	WR	Aus	1 3/32	45	.....	Aus	5 5/16	.3402	SK	.004	.318	120	.....	50	1 5/8	.....	36
37	Packard-Eight 1601,2	L	WR	CNS	1 3/32	30	CNS	5 5/16	.3402	SK	.002	.317	120	.....	50	1 5/8	.....	WR	Aus	1 3/32	45	.....	Aus	5 5/16	.3402	SK	.004	.318	120	.....	50	1 5/8	.....	37
38	Packard-Super Eight 1603,4,5	L	WR	CNS	1 3/32	45	CNS	7 11/32	.3405	SK	.003	.354	159	.....	73	3 1/16	.....	WR	Aus	1 3/32	45	.....	Aus	7 11/32	.3405	SK	.0045	.354	159	.....	73	3 1/16	.....	38
39	Packard-Twelve 1606,7	ML	WR	CNS	1 1/32	45	CNS	6 11/32	.3405	SK	.0025	.312	145	.....	70	2 3/32	.....	WR	Aus	1 3/32	45	.....	Aus	6 11/32	.338	SK	.005	.313	145	.....	70	2 3/32	.....	39
40	Pierce Arrow 1601	L	.....	CNS	1 1/16	45	CNS	4 3/4	.3730	G	.0020	.355	124	1 3/32	62 1/2	2 3/32	2 7/16	.....	SII	1 1/16	45	No	SII	4 3/4	.373	G	.0030	.355	124	1 3/32	62 1/2	2 3/32	2 7/16	40
41	Pierce Arrow 1602	L	.....	3140	1 1/32	45	3140	4 3/4	.3730	G	.0020	.324	124	1 3/32	62 1/2	2 3/32	2 7/16	.....	SII	1 1/16	45	No	SII	4 3/4	.3720	G	.0030	.324	124	1 3/32	62 1/2	2 3/32	2 7/16	41
42	Pierce Arrow 1603	L	.....	3140	1 1/32	45	3140	4 3/4	.3730	G	.0020	.324	124	1 3/32	62 1/2	2 3/32	2 7/16	.....	SII	1 1/16	45	No	SII	4 3/4	.3720	G	.0030	.324	124	1 3/32	62 1/2	2 3/32	2 7/16	42
43	Plymouth P-5	L	.....	CNS	1 1/32	45	CNS	4 31/32	.3405	G	.0020	.312	80	.....	36	.....	.....	.....	SII-1	1 1/32	45	Yes	SII-1	4 31/32	.3405	G	.0040	.312	80	.....	36	.....	.....	43
44	Plymouth P-6	L	.....	CNS	1 1/32	45	CNS	4 31/32	.3405	G	.0020	.312	80	.....	36	.....	.....	.....	SII-1	1 1/32	45	Yes	SII-1	4 31/32	.3405	G	.0040	.312	80	.....	36	.....	.....	44
45	Pontiac-Six 38-26DA	L	Own	SiC	1 11/32	30	SiC	4 11/32	.3105	SC	.0003	11/32	96	1 11/32	54 1/2	1 11/32	2 5/16	Own	SiC	1 11/32	45	No	SiC	4 11/32	.3105	SC	.0003	11/32	96	1 11/32	54 1/2	1 11/32	2 5/16	45
46	Pontiac-Eight 38-28DA	L	Own	SiC	1 11/32	30	SiC	4 3/4	.3105	SC	.0003	11/32	96	1 11/32	54 1/2	1 11/32	2 5/16	Own	SiC	1 11/32	45	No	SiC	4 3/4	.3105	SC	.0003	11/32	96	1 11/32	54 1/2	1 11/32	2 5/16	46
47	Studebaker-Six & Com. 7A-8A	L	WDR	CNS	1 1/32	45	CNS	5 7/16	11/32	G	.0020	11/32	130	1 3/4	59 1/2	2 3/32	.....	WDR	SD	1 3/32	45	No	SD	5 7/16	11/32	G	.0020	11/32	130	1 3/4	59 1/2	2 3/32	.....	47
48	Studebaker-President 4C	L	WDR	CNS	1 1/32	45	CNS	5 7/16	11/32	G	.0020	11/32	130	1 3/4	59 1/2	2 3/32	.....	WDR	SD	1 3/32	45	No	SD	5 7/16	11/32	G	.0020	11/32	130	1 3/4	59 1/2	2 3/32	.....	48
49	Willys 38	L	WR	NC	1 1/32	45	NC	5 5/16	.372	.....	.003	11/32	85 1/2	1 1/16	46 1/2	2 1/4	2 11/16	WR	(a)	1 1/32	45	Yes	(h)	5 5/16	.371	.....	.0040	11/32	85 1/2	1 1/16	46 1/2	2 1/4	2 11/16	49

ABBREVIATIONS:

†—Total for Dual Springs
(a)—G.M.-82120 or S.A.E. 3140
(b)—3140 or 1050
(c)—Inner 1 7/16; Outer 1 11/16
(d)—Inner 1 13/16; Outer 1 11/16
(e)—Inner 1 7/16; Outer 2 7/16
(f)—Silchrome Nos. 1 or 2112
(g)—Inner 2.00; Outer 1 13/16
(h)—No. 93 High Chromium, No. 1 Silchrome or Permite Diachrome
Al-R—Aluminum Industries (Permite) or Rich
Aus—Austenitic Steel
CNS—Chrome Nickel Steel
CN-Si—Chrome Nickel Silchrome Steel
CS—Chrome Silicon Steel
CT—Chrome Nickel Tungsten Steel
D—Drilled
DGS—Double Groove-Split Ring
Ext—Extruded Steel G—Grooved
HS—Horse Shoe I—In-Head
L—Ell-Head ML—Modified Ell-Head
NC—Nickel Chromium
SC—Split Cone or Collar
SD—Silchrome No. 1 or Detroit R-4
SiC—Silicon-Chromium
Sil—Silchrome Steel
Sil-1—Silchrome No. 1
Sil-10—Silchrome No. 10
SK—Slot and Key
Tmp—Thompson Products
TR—Thompson or Rich
W—Wedge
WDR—Wilcox Rich or Detroit
WR—Wilcox-Rich

TIMING GEARS AND VALVE TIMING

Line Number	CAR MAKE AND MODEL	CRANKSHAFT GEAR		CAMSHAFT GEAR		GENERATOR GEAR		TIMING CHAIN					VALVE TAPPET CLEARANCE				VALVE TIMING				Line Number
													Intake		Exhaust		Intake		Exhaust		
		Make	Material	Make	Material	Make	Material	Make	No. of Links	Width	Pitch	Adjustment	Operating	Valve Timing	Operating	Valve Timing	Opens	Closes	Opens	Closes	
1	Bantam....60	Own	CI	Own	CI	No	No	No	No	No	No	No	.006	.006	.006	.006	19B	50AL	57BL	12A	1
2	Buick-Special....38-40	LB	Stl	LB	SS	No	No	LB	49	1.00	.500	No	.015	.004*	.015	.004*	13B	68AL	55BL	22A	2
3	Buick-Century....38-60	LB	Stl	LB	SS	No	No	LB	50	1.00	.500	No	.015	.004*	.015	.004*	14B	71AL	56BL	25A	3
4	Buick-Roadmaster....38-80	LB	Stl	LB	SS	No	No	LB	50	1.00	.500	No	.015	.004*	.015	.004*	14B	71AL	56BL	25A	4
5	Buick-Limited....38-90	LB	Stl	LB	SS	No	No	LB	50	1.00	.500	No	.015	.004*	.015	.004*	14B	71AL	56BL	25A	5
6	Cadillac-V8....38-60	Own	1120	Own	ACI	No	No	Mor	62	1.25	.375	None	AA	AA	AA	AA	TC	42AL	52BL	10A	6
7	Cadillac-V8....38-65	Own	1120	Own	ACI	No	No	Mor	62	1.25	.375	None	AA	AA	AA	AA	TC	42AL	52BL	10A	7
8	Cadillac-V8....38-75	Own	1120	Own	ACI	No	No	Mor	62	1.25	.375	None	AA	AA	AA	AA	TC	42AL	52BL	10A	8
9	Cadillac-Sixteen....38-90	Own	1120	Own	ACI	No	No	Mor	56	1.25	.375	None	AA	AA	AA	AA	8B	28AL	44AL	12A	9
10	Chevrolet-Master....	Own	Stl	Var	BF	No	No	No	No	No	No	None	.006H	.006H	.013H	.013H	9B	29AL	52BL	1B	10
11	Chevrolet-Master De Luxe....	Own	Stl	Var	BF	No	No	No	No	No	No	None	.006H	.006H	.013H	.013H	9B	29AL	52BL	1B	11
12	Chrysler-Royal....C-18	Mor	Stl	Mor	Stl	No	No	Mor	48	1.00	.500	None	.008H	.014	.010H	.014	8B	42AL	48BL	2A	12
13	Chrysler-Imperial....C-19	M-W	Stl	M-W	Stl	No	No	M-W	47	1.25	.500	None	.006H	.011	.010H	.014	2B	44AL	46BL	4A	13
14	Chrysler-Cust. Imp....C-20	Whit	Stl	Whit	SS	No	No	Whit	47	1.25	.500	None	.006H	.011	.010H	.014	2B	44AL	46BL	4A	14
15	De Soto....S-5	Mor	Stl	Mor	Stl	No	No	Mor	48	1.00	.500	None	.008H	.014	.010H	.014	8B	42AL	48BL	2A	15
16	Dodge....D-8	Mor	Stl	Mor	Stl	No	No	Mor	48	1.00	.500	None	.006H	.011	.008H	.012	6A	46AL	42BL	6A	16
17	Ford....																				17
18	Ford....																				18
19	Graham-Special....	LB	Stl	LB	Stl	No	No	LB	46	1.00	.500	None	.010	.012	.010	.012	4½B	47½AL	47½AL	4½A	19
20	Graham-Supercharger....	LB	Stl	LB	Stl	No	No	LB	46	1.00	.500	None	.010	.012	.010	.012	4½B	47½AL	47½BL	4½A	20
21	Hudson-Terraplane....81	Own	CI	GE-D	Bak	No	No	No	No	No	No	None	.008	....	.010	....	10° 40'B	60A	50B	18° 44'A	21
22	Hudson-Terraplane....82	Own	CI	GE-D	Bak	No	No	No	No	No	No	None	.008	....	.010	....	10° 40'B	60A	50B	18° 44'A	22
23	Hudson-Six....83	Own	CI	GE-D	Bak	No	No	No	No	No	No	None	.008	....	.010	....	10° 40'B	60A	50B	18° 44'A	23
24	Hudson-Eight....84,5,7	Own	CI	GE-D	Bak	No	No	No	No	No	No	None	.008	....	.010	....	10° 40'B	60A	50B	18° 44'A	24
25	Hupmobile-Six....E	Mor	Stl	Mor	Stl	No	No	Mor	51	1.00	.500	None	....	....	....	....	....	....	....	....	25
26	Hupmobile-Eight....H	Mor	Stl	Mor	Stl	No	No	Mor	66	1.25	.375	None	....	....	....	....	....	....	....	....	26
27	La Salle-V8....38-50	Own	1120	Own	ACI	No	No	Mor	62	1.25	.375	None	AA	AA	AA	AA	TC	42AL	52BL	10AT	27
28	Lincoln....V-12	Own	Stl	Own	Stl	Own	Stl	Mor	104	1.50	.375	AA	AA	AA	AA	AA	....	....	....	....	28
29	Lincoln-Zephyr....	Own	Stl	Con	Bak	No	No	No	No	No	No	None	AA	AA	AA	AA	....	....	....	....	29
30	Nash-Lafay-Mast. & Del....3810	Own	Stl	Own	CI	No	No	Whit	60	9/16	.375	None	.015	.015	.015	.015	SM	SM	SM	SM	30
31	Nash-Amb. Six....3820	Own	Stl	Own	CI	No	No	Whit	60	9/16	.375	None	.008	.008	.015	.015	SM	SM	SM	SM	31
32	Nash-Amb. Eight....3880	Own	Stl	Own	CI	No	No	....	....	9/16	....	None	.015H	.015H	.015H	.015H	SM	SM	SM	SM	32
33	Oldsmobile-Six....F-38	Whit	X-3115	Whit	CI	No	No	Whit	47	1.00	.500	None	.008	....	.011	....	5B	45AL	45BL	5A	33
34	Oldsmobile-Eight....L-38	LB	X-3115	LB	CI	No	No	LB	47	1.00	.500	None	.008	....	.011	....	TC	35AL	45BL	10A	34
35	Packard-Six....1600	Own	Stl	Own	CI	No	No	Mor	58	1.25	.375	None	.007H	.007	.010H	.010	1B	39AL	45BL	5A	35
36	Packard-Eight....1601,2	Own	Stl	Own	CI	No	No	Mor	58	1.25	.375	None	.007H	.007	.010H	.010	1B	39AL	45BL	5A	36
37	Packard-Super Eight....1603,4,5	Own	Stl	Own	Stl	No	No	Mor	70	1.50	.375	None	.006H	.006	.008H	.008	30B	65AL	65BL	30A	37
38	Packard-Twelve....1606,7	Own	Stl	Own	Stl	No	No	Mor	56	1.75	.500	None	AA	AA	AA	AA	TC	45AL	35BL	10A	38
39	Pierce Arrow....1801	Whit	MS	Whit	CI	No	No	Whit	50	1.50	.500	None	Zero	.010	Zero	.010	5A	45AL	40BL	12A	39
40	Pierce Arrow....1802	Whit	MS	Whit	CI	No	No	Whit	53	1.50	.500	None	Zero	.004	Zero	.006	19B	69AL	56BL	28A	40
41	Pierce Arrow....1803	Whit	MS	Whit	CI	No	No	Whit	53	1.50	.500	None	Zero	.004	Zero	.006	19B	69AL	56BL	28A	41
42	Plymouth....P-5	Mor	Stl	Mor	Stl	No	No	Mor	48	1.00	.500	None	.006H	.011	.008H	.012	6A	46AL	42BL	8A	42
43	Plymouth....P-6	Mor	Stl	Mor	Stl	No	No	Mor	48	1.00	.500	None	.006A	.011	.008H	.012	6A	46AL	42BL	8A	43
44	Pontiac-Six....38-26DA	Own	Stl	Own	CI	No	No	Mor	56	1.00	.375	None	.012H	.015*	.012H	.015	5B	39AL	45BL	5A	44
45	Pontiac-Eight....38-28DA	Own	Stl	Own	CI	No	No	Mor	56	1/8	.375	None	.012H	.015	.012H	.015	5B	39AL	45BL	5A	45
46	Studebaker-Six & Com....7A-8A	Own	CI	Con	Cel	No	No	No	No	No	No	None	.016C	.020	.016C	.020	15B	49AL	54BL	10A	46
47	Studebaker-President....4C	Own	CI	Con	Cel	No	No	No	No	No	No	None	.016C	.020	.016C	.020	15B	49AL	54BL	10A	47
48	Willys....38	LB	1020	LB	SS	No	No	LB	47	1.25	.500	None	.004	.010	.006	.010	TC	45AL	40BL	5A	48

ABBREVIATIONS

*—With valve off seat
A—After Top Dead Center
ACI—Alloy Cast Iron
AL—After Lower Dead Center
Au—Automatic
B—Before Top Dead Center
Bak—Bakelite
BF—Bakelite and Fabric Composition
BL—Before Lower Dead Center
C—Cold
Cel—Celeron
Con—Continental Diamond Fibre Co.
GE-D—General Electric or Continental Diam. Fib. Co.
LB—Link Belt
Mor—Morse
MS—Manganese Steel
M-W—Morse or Whitney
SS—Semi Steel
Stl—Steel
SM—Coincidental Sprocket Markings
TC—Top Dead Center
Var—Various
Whit—Whitney Chain Co.

LUBRICATION AND FUEL SYSTEMS

Line Number	CAR MAKE AND MODEL	ENGINE: Type Lubrication	Oil Pressure to: Main Bearings	Oil Pressure to: Connecting Rods	Oil Pressure to: Wristpins	Oil Pressure to: Camshaft Bearings	Oil Pressure to: Rocker Arms	Timing Gears or Chain	Oil Pump Type	Lubricant Recommended S.A.E. No.: Summer	Lubricant Recommended S.A.E. No.: Winter	Normal Oil Pressure Lbs. at M.P.H.	Relief Valve Opens—Lbs. Pressure	Crankcase Capacity—(Quarts)	Oil Pressure Gauge—Make	External Oil Filter—Make	Oil Cooler—Make	CHASSIS: Type	CHASSIS: Make	Gasoline Tank Capacity	FUEL FEED: Type	FUEL FEED: Make	FUEL FEED: Model	CARBURETOR: Make	CARBURETOR: Model	CARBURETOR: Size	CARBURETOR: Type	SUPERCHARGER: Make	SUPERCHARGER: Type	SUPERCHARGER: How Driven	Manifold Heat Control	Automatic Choke—Make	Air Cleaner—Make	Exhaust Pipe Diameter	Muffler—Make	Line Number
1	Bantam....60	P	Y	J	N	Y	No	Sp	Va	30	20W	8½–30	40	1½	SW	No	No	P	A-H	5	Gr(a)	AC(a)	.....	Tll	.....	¾	SU	No	No	No	No	No	No	1½	Buf	1
2	Buick-Special....38-40	P	Y	Y	N	Y	Y	Po	G	(d)	10W	45–35	45	6	AC	No	No	P	Lin	18	CP	AC	W	SM	(b)	1	DD	No	No	No	Th	DR	AC	2	Wal	2
3	Buick-Century....38-60	P	Y	Y	N	Y	Y	Po	G	(d)	10W	45–35	45	8	AC	No	No	P	Lin	18	CP	AC	AB	SM	(c)	1¼	DD	No	No	No	Th	DR	AC	2½	Wal	3
4	Buick-Roadmaster....38-60	P	Y	Y	N	Y	Y	Po	G	(d)	10W	45–35	45	8	AC	No	No	P	Lin	20	CP	AC	AB	SM	(c)	1¼	DD	No	No	No	Th	DR	AC	2½	Wal	4
5	Buick-Limited....38-90	P	Y	Y	N	Y	Y	Po	G	(d)	10W	45–35	45	8	AC	No	No	P	Lin	20	CP	AO	AB	SM	(c)	1¼	DD	No	No	No	Th	DR	AC	2¼	Wal	5
6	Cadillac-V8....38-60	P	Y	Y	Y	Y	N	Po	G	30	20W	25–30	30	7	AC	No	No	P	Lin	22	CP	AC	AB	Str	AA-V25	1¼	DD	No	No	No	No	Str	AC	2¼	.....	6
7	Cadillac-V8....38-65	P	Y	Y	Y	Y	N	Po	G	30	20W	25–30	30	7	AC	No	No	P	Lin	25	CP	AC	AB	Str	AA-V25	1¼	DD	No	No	No	No	Str	AC	2½	Wal	7
8	Cadillac-V8....38-75	P	Y	Y	Y	Y	N	Po	G	30	20W	25–30	30	7	AC	No	No	P	Lin	25	CP	AC	AB	Str	AA-V25	1¼	DD	No	No	No	No	Str	AC	2½	Wal	8
9	Cadillac-Sixteen....38-90	P	Y	Y	N	Y	N	Po	G	30	20W	25–30	30	11	AC	No	No	P	Lin	25	DP	AC	.....	Car	WDO	1⅜	DD	No	No	No	No	Car	AC	2½	.....	9
10	Chevrolet-Master....C	P	Y	Y	N	Y	Y	Po	G	20	20W	13½–50	75	5	AC	No	No	P	.....	14	CP	AC	AF	Car	W1	1¼	SD	No	No	No	Au	No	AC	1⅞	Own	10
11	Chevrolet-Master De Luxe....C	P	Y	Y	N	Y	Y	Po	G	20	20W	13½–50	75	6	AC	No	No	P	.....	14	CP	AC	AF	Car	W1	1½	SD	No	No	No	Au	No	AC	1⅞	Own	11
12	Chrysler-Royal....C-18	P	Y	Y	N	Y	N	Po	G	30	20W	40–20	42	5	.....	Pur	No	P	Al	16	CP	AC	.....	Car	BB	1½	SD	Ne	No	No	Au	Car	BA	2	NS	12
13	Chrysler-Imperial....C-19	P	Y	Y	N	Y	N	Po	G	30	20W	40–20	42	6	.....	Pur	No	P	Al	16	CP	AC	.....	Str	AAV-2	1¼	DD	No	No	No	Au	Str	AC	2	NS	13
14	Chrysler-Cust. Imp....C-20	P	Y	Y	N	Y	N	Po	G	30	20W	40–20	42	6	.....	Pur	No	P	Al	20	CP	AC	.....	Str	AAV-2	1¼	DD	No	No	No	Au	Str	AC	2¼	NS	14
15	De Soto....S-5	P	Y	Y	N	Y	N	Po	G	30	20W	40–20	42	5	.....	Pur	No	P	Al	16	CV	AC	.....	Car	BB	1½	SD	No	No	No	Au	Car	AC	2	NS	15
16	Dodge....D-8	P	Y	Y	N	Y	N	Po	G	30	20W	40 20	42	5	.....	Pur	No	P	A-H	16	CV	AC	.....	Str	EXV-2	1¼	SD	No	No	No	Au	Str	AC	2	NS	16
17	Ford																																			17
18	Ford																																			18
19	Graham-Special	P	Y	Y	N	Y	N	Po	G	40	20W	45–30	50	5	.....	Fram	No	P	A-H	16	CP	AC	.....	Mar	.....	1½	SP	No	No	No	Au	.....	Bur	2	Old	19
20	Graham-Supercharger	P	Y	Y	N	Y	N	Po	G	40	20W	45–30	50	5	.....	Fram	No	P	A-H	16	CP	AC	.....	Mar	.....	1½	SD	Own	Ce	DB	Au	.....	Bur	1½ D	Old	20
21	Hudson-Terraplane....81	Sp	N	N	N	N	N	Sp	OP	30	20W	3	3	5	No	No	No	P	A-H	16½	CP	AC	AP	Car	WI-397S	1¼	SD	No	No	No	Man	No	AC	2	Old	21
22	Hudson-Terraplane....82	Sp	N	N	N	N	N	Sp	OP	30	20W	3	3	5	No	No	No	P	A-H	16½	CP	AC	AP	Car	WDO-402S	1	DD	No	No	No	Au	Car	AC	2	Old	22
23	Hudson-Six....83	Sp	No	No	No	No	No	Sp	OP	30	20W	3	3	5	No	No	No	P	A-H	16½	CP	AC	AP	Car	WDO-402S	1	DD	No	No	No	Au	Car	AC	2	Old	23
24	Hudson-Eight....84,5,7	Sp	No	No	No	No	No	Sp	OP	30	20W	3	3	7	No	No	No	P	A-H	16½	CP	AC	AP	Car	WDO-402S	1	DD	No	No	No	Au	Car	AC	2	Old	24
25	Hupmobile-Six....E	P	Y	Y	Y	Y	N	Po	G	30	20	30–30	.....	6	.....	.....	No	.....	.....	16	CP	AC	.....	Car	W-1	1¼	T-V-S	No	No	No	.....	.....	AC	.....	.....	25
26	Hupmobile-Eight....H	P	Y	Y	Y	Y	N	Po	G	30	20	30–30	.....	8	.....	.....	No	.....	.....	16	CP	AC	.....	Car	WDO	1	T-V-D	No	No	No	.....	.....	AC	.....	.....	26
27	La Salle-V8....38-50	P	Y	Y	Y	Y	N	Po	G	30	20W	25–30	30	7	AC	No	No	P	Lin	22	CV	AC	AB	Car	WDO-392S	1½	DD	No	No	No	No	Car	AC	2¼	Wal	27
28	Lincoln....V-12	P	Y	Y	N	Y	N	Po	G	40	20W	40–50	40	12	.....	Pur	Yes	P	A-H	26	CP	AC	.....	Str	EE-22	1⅛	DD	No	No	No	.....	.....	AC	2⅛	Own	28
29	Lincoln-Zephyr....P	P	Y	Y	N	Y	N	Po	G	.....	.....	.....	.....	5	.....	Fram	.....	19	MP	AC	.....	DD	No	No	No	.....	.....	.....	1½‡	Own	29
30	Nash-Lafay-Mast. & DeL...3810	P	Y	Y	Y	Y	N	Po	G	30	20	30–20	30	6	KS	No	No	P	A-H	20	CP	AC	AE	Str	EX-22	1¼	SD	No	No	No	No	No	AC	2	Wal	30
31	Nash-Amb. Six....3820	P	Y	Y	Y	Y	Y	Po	G	30	20	30–20	30	7	KS	B&S	No	P	A-H	20	CP	AC	.....	Mar	.....	1½	SD	No	No	No	No	No	AC	2	Wal	31
32	Nash-Amb. Eight....3880	P	Y	Y	Y	Y	Y	Po	G	30	20	30–20	30	7	KS	B&S	No	P	A-H	20	CP	AC	.....	Str	EE-7	1	DD	No	No	No	No	No	AC	2¼	WD	32
33	Oldsmobile-Six....F-38	P	Y	Y	Y	Y	N	Po	G	.....	.....	27–	27	6	AC	No	No	P	.....	18	CP	AC	AH	Car	W-1-388S	1¼	SD	No	No	No	Au	Car	AC	2	Var	33
34	Oldsmobile-Eight....L-38	P	Y	Y	Y	Y	N	Po	G	.....	.....	27–	27	7	AC	No	No	P	.....	18	CP	AC	AH	Car	WDO-389S	1	DD	No	No	No	Au	Car	AC	.....	Var	34
35	Packard-Six....1600	P	Y	Y	Y	Y	N	Po	G	30	20W	35–	.....	6	.....	Yes	No	P	.....	17	CV	AC	.....	CG	.....	1¼	SD	No	No	No	Au	CG	AC	2	.....	35
36	Packard-Eight....1601,2	P	Y	Y	Y	Y	N	Po	G	30	20W	35–	.....	6	.....	Pur	No	P	.....	20	CV	AC	.....	Str	EE-14	1	DD	No	No	No	Au	Str	AC	2¼	.....	36
37	Packard-Super Eight....1603,4,5	P	Y	Y	Y	Y	N	Po	G	30	20W	50–	.....	8	.....	Pur	Yes	P	.....	25	CV	AC	.....	Str	EE-23	1¼	DD	No	No	No	Au	Str	AC	2¼	.....	37
38	Packard-Twelve....1606,7	P	Y	Y	Y	Y	N	Po	G	30	20W	50–	.....	10	.....	Pur	Yes	P	.....	30	CV	AC	.....	Str	EE-3	1½	DD	No	No	No	Au	Str	AC	2¾	.....	38
39	Pierce Arrow....1601	P	Y	Y	Y	Y	N	Po	G	30	20W	45–53	50	9	Mot	Pur	Har	P	Al	30	CP	AC	D	Str	EE-3	1½	DD	No	No	No	Au	Str	AC	2½	Buf	39
40	Pierce Arrow....1602	P	Y	Y	Y	Y	N	Po	G	30	20W	45–53	50	11	Mot	Pur	Har	P	Al	30	CP	AC	D	Str	EX-3	1½	2-SD	No	No	No	Au	Str	AC	2½	Buf	40
41	Pierce Arrow....1603	P	Y	Y	Y	Y	N	Po	G	30	20W	45–53	50	11	Mot	Pur	Har	P	Al	30	CP	AC	D	Str	EX-3	1½	2-SD	No	No	No	Au	Str	AC	2½	Buf	41
42	Plymouth....P-5	P	Y	Y	N	Y	N	Po	G	30	20W	40–20	42½	5	.....	Yes*	No	P	Al	16	CP	AC	.....	BC	AO-25	1¼	SD	No	No	No	Au	No	BA	1¾	NS	42
43	Plymouth....P-6	P	Y	Y	N	Y	N	Po	G	30	20W	40–20	42½	5	.....	Pur	No	P	Al	16	CP	AC	.....	Car	BB	1¼	SD	No	No	No	Au	No	BA	1¾	NS	43
44	Pontiac-Six....38-26DA	P	Y	Y	Y	Y	N	Po	G	20	10W	35–40	.....	6†	AC	No	No	P	.....	18	CP	AC	AH	Car	W-1-401S	1¼	SD	No	No	No	Th	Car	AC	2	BH	44
45	Pontiac-Eight....38-28DA	P	Y	Y	Y	Y	N	Po	G	20	10W	35–40	.....	7†	AC	No	No	P	.....	18	CP	AC	AH	Car	W-1-400S	1¼	SD	No	No	No	Th	Car	AC	2	Buf	45
46	Studebaker-Six & Com....7A-8A	P	Y	Y	N	Y	N	Po	G	30	20	40–30	40	5½	Mot	Fram	No	P	Al	18	CP	AC	.....	Str	BXO-26	1¼	SD	No	No	No	Au	Str	AC	2	Buf	46
47	Studebaker-President....4C	P	Y	Y	N	Y	N	Po	G	30	20	40–25	40	8	Mot	Fram	No	P	Al	18	CP	AC	.....	Str	AAO-161	1	DD	No	No	No	Au	Str	AC	1¾	Buf	47
48	Willys....38	P	Y	Y	N	Y	N	Po	G	30	20W	30–30	30	4	KS	No	No	P	Al	8	CP	AC	AF	Tll	U1A	1⅛	SD	No	No	No	Man	No	AC	1½	Buf	48

ABBREVIATIONS:

*—At Extra Cost
†—Dry ‡—Inside Diameter
(a)—Camshaft Pump available at extra cost
(b)—Stromberg AAV-1 or Marvel CD-1B
(c)—Stromberg AAV-2 or Marvel CD-2B
(d)—Use grade suited to atmospheric temperature
A-H—Alemite Hydraulic
Al—Alemite
Au—Automatic
BA—Burgess or AC
BC—Ball & Ball or Chandler Groves
BH—Buffalo or Hayes
Buf—Buffalo
Bur—Burgess
BS—Briggs & Stratton
Car—Carter
CC—Carter or Chandler Groves
Ce—Centrifugal
CG—Chandler-Groves
CP—Camshaft Pump
CV—Camshaft Pump, combination Fuel and Vacuum
D—Dual
DB—Dual V Belts
DD—Dual or Duplex Downdraft
DR—Delco-Remy
DP—Dual Camshaft Pumps
G—Gear
Gr—Gravity feed
Har—Harrison
J—Jet
KS—King Seeley
Lin—Lincoln
Man—Manual
Mot—Motometer Gauge & Equip. Co.
MP—Mechanical Pump
N—No
NS—Noblitt-Sparks
Old—Oldberg
OP—Oscillating Pump
P—Pressure
Po—Positive
Pur—Purolator
2-SD—Single Downdraft—2 used
SD—Single Downdraft
SM—Stromberg or Marvel
Sp—Splash
Str—Stromberg
SU—Single Updraft
SW—Stewart Warner
Th—Thermostatic Type
Tll—Tillotson
TV-D—Triple Venturi—Dual Downdraft
TV-S—Triple Venturi—Single Downdraft
Va—Vane
Var—Various
Wal—Walker
WD—Walker Dual
Y—Yes

COOLING AND IGNITION SYSTEMS

Line Number	CAR MAKE AND MODEL	WATER PUMP Type	WATER PUMP Drive	Thermostat—Make	By-pass for Recirculation	RADIATOR Core Type	RADIATOR Core Make	RADIATOR Lower Hose (In.) Inside Diameter	RADIATOR Lower Hose (In.) Length	RADIATOR Upper Hose (In.) Inside Diameter	RADIATOR Upper Hose (In.) Length	Cooling System Capacity (Quarts)	Full Length Waterjackets	FAN BELT Number Used	FAN BELT Type	FAN BELT Length Outside (In.)	FAN BELT Width (In.)	FAN BELT Make	Make of Fan	IGNITION UNIT Make	IGNITION UNIT MODEL	IGNITION UNIT Degrees Advanced Manual	IGNITION UNIT Degrees Advanced Automatic	IGNITION UNIT Degrees Advanced Vacuum	IGNITION UNIT Breaker Gap	IGNITION UNIT Cam Angle (Deg.)	IGNITION UNIT Timing Spark Occurs Deg.—TDC.	IGNITION UNIT Timing Firing Order	COIL Make	COIL Amperage Draw Engine Stopped	COIL Amperage Draw Engine Idling	Ignition Switch Make	SPARK PLUG Make	SPARK PLUG Model	SPARK PLUG Thread	SPARK PLUG Gap	Line Number
1	Bantam 60			No	No	Tu	Jam					7	No	1	V-42		5/8		SC	AL	IGB-4086-A	No	22	No	.022	40		1-3-4-2	AL	5.0	2.0	Dou	Ch	6&7	14	.025	1
2	Buick-Special 38-40	Ce	FB	Har	Yes	Cel	Har	1 1/8	7	1 7/16	ET	13 1/4	No	1	V-45	42 7/16	2 1/2	DF	Hay	DR	1110801	10†	24†	12†	.015	31	4B**	1-6-2-5-8-3-7-4	DR	4.5	2.5	Oak	AC	46	14	.025	2
3	Buick-Century 38-60	Ce	FB	Har	Yes	Cel	Har	1 3/16	5 1/4	1 3/16	ET	17	No	1	V-45	45 1/16	2 1/2	Gyr	Hay	DR	1110801	10†	24†	12†	.015	31	6B**	1-6-2-5-8-3-7-4	DR	4.5	2.5	Oak	AC	46	14	.025	3
4	Buick-Roadmaster 38-80	Ce	FB	Har	Yes	Cel	Har	1 3/16	5 1/4	1 3/16	ET	17	No	1	V-45	45 1/16	2 1/2	Gyr	Hay	DR	1110801	10†	24†	12†	.015	31	6B**	1-6-2-5-8-3-7-4	DR	4.5	2.5	Oak	AC	46	14	.025	4
5	Buick-Limited 38-90	Ce	FB	Har	Yes	Cel	Har	1 1/16	5 1/4	1 3/16	ET	17	No	1	V-45	45 1/16	2 1/2	Gyr	Hay	DR	1110801	10†	24†	12†	.015	31	6B**	1-6-2-5-8-3-7-4	DR	4.5	2.5	Oak	AC	46	14	.025	5
6	Cadillac-V8 38-60	Ce	FB	Har	....	Cel	Har	2	6 3/4	1 1/4	2-10 1/8	....	Yes	1	V-34	11 1/2 C	1 1/4	Gyr	Hay	DR	665-G	20	22	No	.015	31	5B	1-8-7-3-6-5-4-2	DR	4.4	2.2	DR	AC	45	14	.027	6
7	Cadillac-V8 38-65	Ce	FB	Har	....	Cel	Har	2	7 1/4	1 1/4	2-10 3/4	25	Yes	1	V-34	11 1/2 C	1 1/4	Gyr	Hay	DR	665-G	20	22	No	.015	31	5B	1-8-7-3-6-5-4-2	DR	4.4	2.2	DR	AC	45	14	.027	7
8	Cadillac-V8 38-75	Ce	FB	Har	....	Cel	Har	2	7 1/4	1 1/4	2-10 3/4	25	Yes	1	V-34	11 1/2 C	1 1/4	Gyr	Hay	DR	665-G	20	22	No	.015	31	5B	1-8-7-3-6-5-4-2	DR	4.4	2.2	DR	AC	45	14	.027	8
9	Cadillac-Sixteen 38-90	2-Ce	FB	Har	....	Cel	Har	1 3/4	2-4 3/4	1 1/2	2-10 1/4	....	Yes	2	V-34	50 3/4	5/8	Gyr	Hay	DR	1110601,2	20	28	No	.015	31	.....	(a)	DR	4.4	2.2	DR	AC	84	18	.027	9
10	Chevrolet-Master Ce	Ce	FB	Har	No	Cel	Har	1 1/2	(f)	1 1/4	5 5/8	14	Yes	1	V-32	42 1/2	11/16	Var	Own	DR	1110008	No	46	17	.021	35	5B	1-5-3-6-2-4	DR	4.8	2.5	DR	AC	46	14	.040	10
11	Chevrolet-Master De Luxe Ce	Ce	FB	Har	No	Cel	Har	1 1/2	(f)	1 1/4	5 5/8	14	Yes	1	V-32	42 1/2	11/16	Var	Own	DR	1110008	No	46	17	.021	35	5B	1-5-3-6-2-4	DR	4.8	2.5	DR	AC	46	14	.040	11
12	Chrysler-Royal C-18	Ce	FB	Ful	Yes	Cel	Jam	1 3/4	6 1/4	1 1/2	(k)	20	Yes	1	V-	.....	.....	.....	.....	AL	IGS-4010-C-1	No	24	16	.020	38	.....	1-5-3-6-2-4	AL	5.0	2.0	Mit	.....	.....	14	.025	12
13	Chrysler-Imperial C-19	Ce	FB	Ful	Yes	Tu	Long	1 3/4	5 1/4	1 3/4	(m)	20	Yes	1	V-	.....	.....	.....	.....	AL	IGT-4001-K1	No	24	18	.018	31	.....	1-6-2-5-8-3-7-4	AL	5.0	2.0	Mit	.....	.....	14	.025	13
14	Chrysler-Cust. Imp C-20	Ce	FB	Ful	Yes	Tu	Long	1 3/4	5 1/4	1 3/4	(m)	20	Yes	1	V-	.....	.....	.....	.....	AL	IGT-4001-F1	No	22	14	.018	31	.....	1-6-2-5-8-3-7-4	AL	5.0	2.0	Mit	.....	.....	14	.025	14
15	De Soto S-5	Ce	FB	Ful	Yes	Cel	Jam	1 3/4	6 1/4	1 1/2	(k)	20	Yes	1	V-	.....	.....	.....	.....	AL	IGS-4010-C1	No	24	16	.020	38	.....	1-5-3-6-2-4	AL	5.0	2.0	.....	AL	A-7	14	.025	15
16	Dodge D-8	Ce	FB	Ful	Yes	Cel	.....	1 3/4	6 1/2	1 1/2	(k)	15	Yes	1	V-	.....	.....	.....	.....	AL	IGS-4002-A1	No	24	18	.020	38	.....	1-5-3-6-2-4	AL	5.0	2.0	Mit	.....	.....	14	.025	16
17	Ford																																				17
18	Ford																																				18
19	Graham-Special Ce	Ce	FB	Ful	No	Cel	Har	.....	.....	.....	.....	15	Yes	1	V-38	44	21/32	Gr	SC	DR	623-A	No	18	10	.018	35	4B	1-5-3-6-2-4	DR	.....	.....	.....	Ch	J-9	14	.025	19
20	Graham-Supercharger Ce	Ce	FB	Ful	No	Cel	Har	.....	.....	.....	.....	16 1/2	Yes	1	V-38	44	21/32	Gr	SC	DR	623-S	No	18	10	.018	35	4B	1-5-3-6-2-4	DR	.....	.....	.....	Ch	J-9	14	.025	20
21	Hudson-Terraplane 81	Va	FB	No	No	Cel	McC	1.562	8 1/2	1.5	10	12 1/2	No	1	V-42	44 5/8	.781	Gr	Own	AL	IGW-4104A	No	28	No	.020	34	TC	1-5-3-6-2-4	AL	4.5	2.5	Mit	Ch	J-8-A	14	.032	21
22	Hudson-Terraplane 82	Va	FB	B&B	Yes	Cel	McC	1.562	8 1/2	1.5	10	12 1/2	No	1	V-42	44 5/8	.781	Gr	Own	AL	IGW-4103A	No	28	No	.020	34	TC	1-5-3-6-2-4	AL	4.5	2.5	Mit	Ch	J-8-A	14	.032	22
23	Hudson-Six 83	Va	FB	B&B	Yes	Cel	McC	1.562	3	1.5	10	12 1/2	No	1	V-42	44 5/8	.781	Gr	Own	AL	IGW-4103A	No	28	No	.020	34	TC	1-5-3-6-2-4	AL	4.5	2.5	Mit	Ch	J-8-A	14	.032	23
24	Hudson-Eight 84,5,7	Va	FB	B&B	Yes	Cel	McC	1.562	3	1.5	10	17 1/2	No	1	V-42	44 3/8	.781	Gr	Own	AL	IGP-4008A	No	35	No	.017	31	TC	1-6-2-5-8-3-7-4	AL	4.5	2.5	Mit	Ch	J-8-A	14	.032	24
25	Hupmobile-Six E	Ce	FB	Yes	....	Cel	Jam	.....	.....	.....	.....	18	Yes	1	V-	.....	3/4	.....	.....	AL	IGC-4227	No	25	No	.019	31	.....	1-5-3-6-2-4	AL	5.0	2.0	Mit	Ch	7	18	.028	25
26	Hupmobile-Eight H	Ce	FB	Yes	....	Cel	Jam	.....	.....	.....	.....	21 1/2	Yes	1	V-	.....	3/4	.....	.....	AL	IGT-4008	No	13	16	.016	31	.....	1-4-7-3-8-5-2-6	AL	5.0	2.0	Mit	Ch	7	18	.028	26
27	La Salle-V8 38-50	Ce	FB	Har	....	Cel	Har	2	7 1/4	1 1/4	2-10 3/4	25	Yes	1	V-	.....	1 1/4	Gyr	Hay	DR	665-G	20	22	No	.015	31	5B	1-8-7-3-6-5-4-2	DR	4.4	2.2	DR	AC	45	14	.027	27
28	Lincoln V-12	Va	GS							1 3/4	8 3/4	32		1	V-45	40.75	1.00	Var		AL	IGM-4003-A	20	20	No	.015	36	.....	(h)	AL	5.0	2.0	.....	Ch	7	18	.025	28
29	Lincoln-Zephyr	Ce				McC[c]						30	Yes	1	V-28	54.4	.63	Var	Own	Own								(h)					Ch	H-10	14	.028	29
30	Nash-Lafay-Mast. & DeL. 3810	Ce	GS	Do	No	Tu	Mod	.....	.....	.....	.....	20	Yes	1	V-32	.....	.....	.....	SC	AL	IGC-4276	No	30	No	.022	40	4A	1-5-3-6-2-4	AL	4.0	2.5	HH	AL	B-7	18	.025	30
31	Nash-Amb. Six 3820	Ce	GS	Do	No	Tu	Mod	.....	.....	.....	.....	20	Yes	1	V-32	.....	.....	.....	SC	AL	IGE-4018	No	26	No	.020	38	4B	1-5-3-6-2-4	AL	5.0	2.0	HH	AC	45	14	.025	31
32	Nash-Amb. Eight 3880	Ce	GS	Do	No	Tu	Mod	.....	.....	.....	.....	18	Yes	1	V-32	.....	.....	.....	SC	AL	IGK-4102	No	24	No	.020	....	9B	1-6-2-5-8-3-7-4	AL	4.0	2.5	HH	AC	45	14	.025	32
33	Oldsmobile-Six F-38	Ce	FB	Har	Yes	Cel	Har	1 1/16	11	1 1/2	8 3/4	17	Yes	1	V-32	44 11/16 *	11/16	Var	Own	DR	647-F	No	25	34	.020	35	TC	1-5-3-6-2-4	DR	4.5	2.0	DR	AC	45	14	.040	33
34	Oldsmobile-Eight L-38	Ce	FB	Har	Yes	Cel	Har	1 3/4	11	1 1/2	8 3/4	21	Yes	1	V-32	44 11/16 *	11/16	Var	Own	DR	1110802	No	27 1/2	33	.015	31	2B	1-6-2-5-8-3-7-4	DR	4.5	2.0	DR	AC	45	14	.030	34
35	Packard-Six 1600	Ce	FB	Yes	....	Cel	McC	1 3/4	3	1 3/4	7	15	....	1	V-42	43	3/4	.....	.....	DR	647-E				.020	35	6B	1-5-3-6-2-4	DR	.5	2.5	.....	CA	(c)	10	.027	35
36	Packard-Eight 1601,2	Ce	FB	Yes	....	Cel	Har	1 3/4	3	1 3/4	7	16	....	1	V-42	43	3/4	.....	.....	AL	IGT-4007	No	17 1/2	15	.015	31	8B	1-6-2-5-8-3-7-4	AL	.5	2.5	Mit	CA	(c)	10	.027	36
37	Packard-Super Eight 1603,4,5	Ce	FB	Yes	....	Tu	McC	1 3/4	7 11/16	1 3/4	9	20	....	1	V-42	47 5/8	1	.....	.....	AL	IGT-4006	No	18	11	.015	31	6B	1-6-2-5-8-3-7-4	AL	.5	2.5	Mit	CA	(c)	10	.027	37
38	Packard-Twelve 1606,7	Ce	FB	Yes	....	Tu	McC	2	7 3/4	1 1/2	(b)	40	....	1	V-45	49 3/8	3/4	.....	.....	AL	IGO-4002A	No	16	No	.020	31	6B	(d)	AL	.5	2.5	Mit	CA	(e)	10	.027	38
39	Pierce Arrow 1801	Ce	FB	No	No	Tu	Long	2 1/4	3 1/4	1 1/2	14	28	Yes	2	V-45	52 5/8	5/8	Fir	SC	DR	662-J	33	18	15	.018	....	5B	1-6-2-5-8-3-7-4	DR	2.0	4.0	DR	Ch	J-6	14	.023	39
40	Pierce Arrow 1802	Ce	FB	No	No	Tu	Long	2 1/4	18 3/4	1 1/2	(g)	40	Yes	2	V-45	57 1/2	5/8	Fir	SC	DR	4105	33	12	No	.018	....	5B	(h)	DR	2.0	4.0	DR	Ch	J-6	14	.023	40
41	Pierce Arrow 1803	Ce	FB	No	No	Tu	Long	2 1/4	18 3/4	1 1/2	(g)	40	Yes	2	V-45	57 1/2	5/8	Fir	SC	DR	4105	33	12	No	.018	....	5B	(h)	DR	2.0	4.0	DR	Ch	J-6	14	.023	41
42	Plymouth P-5	Ce	FB	.....	RS	Cel	M-J	1 3/4	6 1/2	1 1/2	(k)	14	Yes	1	V-	.....	.....	.....	.....	AL	IGS-4003-B1	No	22	20	.020	38	.....	1-5-3-6-2-4	AL	5.0	2.0	Mit	.....	.....	14	.025	42
43	Plymouth P-6	Ce	FB	.....	Yes	Cel	M-J	1 3/4	6 1/2	1 1/2	(k)	14	Yes	1	V-	.....	.....	.....	.....	AL	IGS-4003-B1	No	22	20	.020	38	.....	1-5-3-6-2-4	AL	5.0	2.0	Mit	AL	A-7	14	.025	43
44	Pontiac-Six 38-26DA	Ce	FB	Har	Yes	Cel	Har	1 1/2	9 1/2	1 3/4	9 3/4	16	Yes	1	V-28	46 11/16	3/4	Own	Own	DR	647-D	20	22	15	.020	36	2-1/10B	1-5-3-6-2-4	DR	.....	.....	DR	AC	45-14	14	.025	44
45	Pontiac-Eight 38-28DA	Ce	FB	Har	Yes	Cel	Har	1 1/2	9 1/2	1 3/4	9 3/4	19	Yes	1	V-28	46 11/16	3/4	Own	Own	DR	663X	20	22	20	.015	31	2-1/10B	1-6-2-5-8-3-7-4	DR	.....	.....	DR	AC	45-14	14	.025	45
46	Studebaker-Six & Com. 7A-8A	Ce	FB	Var	Yes	Tu	McC	2	11	1 1/4	10 1/4	14 1/2	Yes	1	V-38	47 1/2	11/16	Var	SC	AL	IGW-4101	No	11	6	.020	34	2B	1-5-3-6-2-4	AL	4.5	1.0	Mit	Ch	8	18	.025	46
47	Studebaker-President 4C	Ce	FB	Var	Yes	Tu	McC	2	10 1/16	1 1/4	11 1/2	17	Yes	1	V-38	47 1/2	11/16	Var	SC	DR	662-M	....	13 1/2	6	.020	....	TC	1-6-2-5-8-3-7-4	DR	4.5	1.0	DR	Ch	8	18	.025	47
48	Willys 38	Ce	FB	No	No	Cel	Jam	1 7/16	(e)	1 1/2	10 3/4	11	No	1	V-42	42 1/2	21/32	Var	Own	AL	IGS-4007	No	29	20	.020	47	5A	1-3-4-2	AL	4.0	2.5	Dou	Ch	C7	18	.025	48

ABBREVIATIONS:

*—Inside †—Degrees on Flywheel
‡—Advance or Retard on Octane Selector
**—With Octane Selector in Midposition
°—Part Productiou

(a)—1L, 4R, 9L, 12R, 3L, 16R, 11L, 8R, 15L, 4R, 7L, 6R, 13L, 2R, 5L, 10R
(b)—One 11 7/16; one 12 5/16
(c)—AC-103 or Champion Y4
(d)—1R, 6L, 5R, 2L, 3R, 4L, 6R, 1L, 2R, 5L, 4R, 3L
(e)—One 5 1/16; one 2 1/2 (f)—One 2 3/4; one 5
(g)—One 10 1/2; one 9 1/2
(h)—1, 4, 9, 8, 5, 2, 11, 10, 3, 6, 7, 12
(k)—One 3 1/2; one 5 1/4
(m)—One 2 3/4; one 5 1/4 2—Two used
A—After AL—Auto-Lite B—Before
B&B—Bishop & Babcock
C—Center to Center

CA—Champion or AC Ce—Centrifugal
Cel—Cellular Ch—Champion
DF—Dayton or Firestone Do—Dole
Dou—Douglass DR—Delco Remy
ET—Elbow Type FB—Fan Belt
Ful—Fulton Gr—Goodrich
GS—Generator Shaft Gyr—Goodyear
Har—Harrison Hay—Hayes Industries
HH—Houde-Hershey Jam—Jamestown
McC—McCord
Mit—Mitchell Specialty Co.
M-J—McCord or Jamestown
Mod—Modine
Oak—Oakes
RS—Restriction Thermostat
SC—Schwitzer-Cummins
Tu—Tubular or Fin & Tube
Va—Vane

STARTING MOTORS AND BATTERIES

Line Number	CAR MAKE AND MODEL	STARTING MOTOR																BATTERY						Line Number
		Make	Model	Cranking Speed	Lock Test			No Load Test			Drive—Type	Starting Method		Pinion Meshes	Flywheel				Make	Capacity—Amp. Hrs. 20 M. P. H.	Plates per Cell	Bench Charging Rate		Terminal Grounded	
					Amperage Draw	Volts	Torque (Ft. Lbs.)	Amperage Draw	Volts	R. P. M.		Make	Type		No. of Teeth	Face Width of Teeth	Teeth Integral	Ratio to Starter				Start	Finish		
1	Bantam.....60	AL	MAK-4001	120	520	4.00	7.0	70	5.5	5000	Ben	Ben	FP	F	80	⅛		8.10	Wil	65	11				1
2	Buick-Special.....38-40	DR	734-Z	.....	575	3.40	12.0	65	5.0	5000	OC	DR	AcS	F	146	⅛	SR	16.22	Del	110	17			Neg	2
3	Buick-Century.....38-80	DR	727-W	.....	600	3.00	16.0	65	5.0	5500	OC	DR	AcS	F	156	⅛	SR	17.33	Del	110	17			Neg	3
4	Buick-Roadmaster.....38-80	DR	727-W	.....	600	3.00	16.0	65	5.0	5500	OC	DR	AcS	F	156	⅛	SR	17.33	Del	110	17			Neg	4
5	Buick-Limited.....38-90	DR	727-W	.....	600	3.00	16.0	65	5.0	5500	OC	DR	AcS	F	156	⅛	SR	17.33	Del	110	17			Neg	5
6	Cadillac-V8.....38-60	DR	727-V	.....	600	3.0	16.0	65	5.0	5500	SG	DR	PB	F	156	⅛	SR	17.00	Del	110	17	10.0	8.00	Pos	6
7	Cadillac-V8.....38-65	DR	727-V	.....	600	3.0	16.0	65	5.0	5500	SG	DR	PB	F	156	⅛	SR	17.00	Del	110	17	10.0	8.00	Pos	7
8	Cadillac-V8.....38-75	DR	727-V	.....	600	3.0	16.0	65	5.0	5500	SG	DR	PB	F	156	⅛	SR	17.00	Del	130	17	10.0	8.00	Pos	8
9	Cadillac-Sixteen.....38-90	DR	714	.....	500	3.0	19.0	70	5.0	3000	SG	DR	PB	F	156	⅛	SR	17.00	Del	164	21	10.0	8.00	Pos	9
10	Chevrolet-Master.....	DR	1107001	65	525	3.4	14.0	125	5.4	2500	OC	DR	FP	F	139	⅛	SR	15.44	Del	100	17	6.0	5.00	Neg	10
11	Chevrolet-Master De Luxe.....	DR	1107001	65	525	3.4	14.0	125	5.4	2500	OC	DR	AcS	F	139	⅛	SR	15.44	Del	100	17	6.0	5.00	Neg	11
12	Chrysler-Royal.....C-18	AL	MAX-4020-A	125	880	4.0	25.0	65	5.5	5300	SG	AL	PB	F	146	⅛	SR	16.22	Wil	119	15	.....	.....	Pos	12
13	Chrysler-Imperial.....C-19	AL	MAX-4037	120	880	4.0	25.0	65	5.5	5300	SG	AL	PB	F	146	⅛	SR	16.22	Wil	120	17	.....	.....	Pos	13
14	Chrysler-Cust. Imp.....C-20	AL	MAX-4038	120	880	4.0	25.0	65	5.5	5300	SG	AL	PB	F	146	⅛	SR	16.22	Wil	136	17	.....	.....	Pos	14
15	De Soto.....S-5	AL	MAW-4010	120	670	4.0	18.0	65	5.5	4900	MG	AL	FP	F	146	⅛	SR	16.22	Wil	105	15	.....	.....	Pos	15
16	Dodge.....D-8	AL	MAW-4010	123	670	4.0	18.0	65	5.5	4900	MG	AL	FP	F	146	⅛	SR	16.22	Wil	95	15	.....	.....	Pos	16
17	Ford.....																								17
18	Ford.....																								18
19	Graham-Special.....	DR	738-T	.....	475	3.63	12.0	65	5.0	5000	OC	.....	FP	F	130	⅛	SR	14.40	Wil	105	15	.....	.....	Pos	19
20	Graham-Supercharger.....	DR	738-T	.....	475	3.63	12.0	65	5.0	5000	OC	.....	FP	F	130	⅛	SR	14.40	Wil	105	15	.....	.....	Pos	20
21	Hudson-Terraplane.....81	AL	MAB-4075	150	780	4.0	22.5	60	5.5	2250	Ben	AL	PB	R	134	.406	SR	14.90	Nat	107	17	5.0	3.00	Pos	21
22	Hudson-Terraplane.....82	AL	MAB-4075	150	780	4.0	22.5	60	5.5	2250	Ben	AL	PB	R	134	.406	SR	14.90	Nat	105	17	5.0	3.00	Pos	22
23	Hudson-Six.....83	AL	MAB-4075	150	780	4.0	22.5	60	5.5	2250	Ben	AL	PB	R	134	.406	SR	14.90	Nat	105	17	5.0	3.00	Pos	23
24	Hudson-Eight.....84,5,7	AL	MAB-4075	150	780	4.0	22.5	60	5.5	2250	Ben	AL	PB	R	134	.406	SR	14.90	Nat	125	19	6.0	4.00	Pos	24
25	Hupmobile-Six.....E	AL	MAJ-4044	.....	750	4.0	17.0	67	5.5	4100	Ben	AL	PB	.....	112	.....	.....	.....	Wil	105	15	.....	.....	Pos	25
26	Hupmobile-Eight.....H	AL	MAB-4095	.....	750	4.0	21.5	60	5.5	3700	Ben	AL	PB	.....	109	.....	.....	.....	Wil	120	17	.....	.....	Pos	26
27	La Salle-V8.....38-50	DR	727-V	.....	600	3.0	16.0	65	5.0	5500	SG	DR	PB	F	156	⅛	SR	17.00	Del	110	17	10.0	8.00	Pos	27
28	Lincoln.....V-12	AL	MAO-4003-B	110	975	4.0	48.5	44	5.5	2700	Ben	AL	.....	F	116	.625	SR	11.60	Exl	147	21	10.0	10.00	Neg	28
29	Lincoln-Zephyr.....	Own		90			14.0				Ben			R	112	.375	SR	11.20	Own	100	17	8.0	5.00	Pos	29
30	Nash-Lafay-Mast. & DeL.....3810	AL	MAB-4076	160	750	4.0	21.5	60	5.5	3700	Ben	AL	CP	R	104	⅛	SR	10.40	USL	105	15	.....	.....	Pos	30
31	Nash-Amb. Six.....3820	AL	MAB-4076	160	750	4.0	21.5	60	5.5	3700	Ben	AL	CP	R	104	⅛	SR	10.40	USL	105	15	.....	.....	Pos	31
32	Nash-Amb. Eight.....3880	AL	MAB-4054	160	750	4.0	21.5	60	5.5	3700	Ben	AL	CP	R	.....	.....	SR	11.30	USL	120	17	.....	.....	Pos	32
33	Oldsmobile-Six.....F-38	DR	739-G	100-S	475	3.63	12.0	65	5.0	5000	OC	DR	.....	F	145	⅛	SR	16.11	DR	94	15	12.5	4.50	Neg	33
34	Oldsmobile-Eight.....L-38	DR	729-J	100-S	600	3.00	15.0	60	5.0	6000	OC	DR	.....	F	145	⅛	SR	16.11	DR	110	17	12.5	5.25	Neg	34
35	Packard-Six.....1600	DR	739-F	.....	475	3.63	12.0	65	5.0	5000	Ben	DR	PB	F	140	.....	.....	15.55	Wil	95	21	.....	.....	Pos	35
36	Packard-Eight.....1601,2	AL	MAX-4006	.....	880	4.00	25.0	65	5.5	5300	Ben	AL	PB	F	140	.....	.....	15.55	PD	114	21	.....	.....	Pos	36
37	Packard-Super Eight.....1603,4,5	AL	MAX-4014	.....	880	4.00	25.0	65	5.5	5300	Ben	AL	PB	F	148	.....	.....	16.44	PD	150	21	11.0	11.00	Pos	37
38	Packard-Twelve.....1606,7	AL	DN-1389	125	735	3.60	29.5	50	6.0	3000	Ben	AL	PB	F	118	.....	.....	11.80	PD	150	21	11.0	11.00	Pos	38
39	Pierce Arrow.....1801	Dyn	DI-1314	105	700	3.80	25.0	165	5.4	1600	Ben	Ecl	Stx	F	116	⅛	SR	11.60	Wil	140	17	7.0	.....	Pos	39
40	Pierce Arrow.....1802	Dyn	DI-1313	105	700	3.80	25.0	165	5.4	1600	Ben	Ecl	Stx	F	116	⅛	SR	11.60	Wil	160	19	8.0	.....	Pos	40
41	Pierce Arrow.....1803	Dyn	DI-1313	105	700	3.80	25.0	165	5.4	1600	Ben	Ecl	Stx	F	116	⅛	SR	11.60	Wil	160	19	8.0	.....	Pos	41
42	Plymouth.....P-5	AL	MZ-4056	125	560	4.00	11.8	70	5.5	4300	MG	AL	FP	F	146	⅛	SR	16.22	Wil	90	13	.....	.....	Pos	42
43	Plymouth.....P-6	AL	MAW-4009	.....	670	4.00	18.0	65	5.5	4900	MG	AL	FP	F	146	⅛	SR	16.22	Wil	90	13	.....	.....	Pos	43
44	Pontiac-Six.....38-26DA	DR	729-E	50-55	600	3.0	15.0	60	5.0	6000	OC	DR	.....	F	139	⅛	SR	15.44	Del	98	15	.....	.....	Neg	44
45	Pontiac-Eight.....38-28DA	DR	727-S	50-55	600	3.0	15.0	65	5.0	5500	SG	DR	.....	F	139	⅛	SR	15.44	Del	112	17	.....	.....	Neg	45
46	Studebaker-Six & Com.....7A-8A	AL	MAW-4015	130	600	3.0	12.0	60	5.5	5000	Ben	AL	.....	F	133	⅛	SR	14.78	Wil	105	15	5.75	5.75	Pos	46
47	Studebaker-President.....4C	DR	1107903	110	600	3.0	16.0	60	5.0	5000	OC	DR	.....	F	133	⅛	SR	14.78	Wil	105	15	5.75	5.75	Pos	47
48	Willys.....38	AL	MZ-4049	216	560	4.0	11.8	70	5.5	4300	SG	AL	.....	F	97	⅜	SR	9.7	USL	96	13	4.50	4.50	Neg	48

ABBREVIATIONS:

AcS—Accelerator controlled Solenoid
Au—Automatic
Ben—Bendix
Con—Conventional
CP—Clutch pedal operated
Del—Delco
DR—Delco-Remy
Dyn—Owens Dyneto
Ecl—Eclipse Machine Co.
Exl—Exide
F—Front
FP—Foot Pedal or Button
M—Mild
MG—Manually operated Gear
MS—Manually operated Solenoid
Nat—National
Neg—Negative
OC—Overrunning Clutch
PB—Push or Pull Button
PD—Presto-Lite Hi Level or Delco
Pos—Positive
R—Rear
S—Summer
SG—Solenoid operated Gear
Sol—Solenoid
SR—Steel Ring
Stx—Startix
Wil—Willard

GENERATORS AND LIGHTS

Line Number	MODEL	Make	Model	Driven By	Ventilated	Field Fuse Capacity (Amps.)	Type	CUTOUT RELAY: Model	CUTOUT RELAY: CLOSES AT: Voltage	CUTOUT RELAY: CLOSES AT: Armature R.P.M. (Average)	CUTOUT RELAY: CLOSES AT: Car Speed, M.P.H.	CUTOUT RELAY: Opens at (Amps.)	Charging Control	MAXIMUM CHARGING RATE: COLD: Amperes	COLD: Volts	COLD: Armature, R.P.M.	HOT: Amperes	HOT: Volts	HOT: Armature, R.P.M.	MAXIMUM CHARGING RATE: Car Speed, M.P.H.	Ammeter-Make	LIGHTS: Headlight—Make	LIGHTS: Tail & Stop—Make	Horn—Make	Line Number
1	Bantam.....60	AL	GAS-4104-B	B	No	No	3BR	.....	7.0	880	9.8	N-2.0	3BR	14.0	8.0	2800	10.2	8.0	2800	.....	SW	CR-BR	CR-BR	.....	1
2	Buick-Special.....38-40	DR	1101052	B	Yes	No	C3BR	5807	6.4-7.0	800H	8.0	No-3.5	CVR	29.0	8.0	4000	26.5	8.0	4200	40.0	AC	Guide	Guide	DR	2
3	Buick-Century.....38-60	DR	1101053	B	Yes	No	C3BR	5807	6.4-7.0	800	8.0	0-3.5	CVR	29.0	8.0	4000	26.5	8.0	4200	43.0	AC	Guide	Guide	DR	3
4	Buick-Roadmaster.....38-80	DR	1101055	B	Yes	No	C3BR	5807	6.4-7.0	800	8.5	0-3.5	CVR	29.0	8.0	4000	26.5	8.0	4200	44.0	AC	Guide	Guide	DR	4
5	Buick-Limited.....38-90	DR	1101055	B	Yes	No	C3BR	5807	6.4-7.0	800	8.0	0-3.5	CVR	29.0	8.0	4000	26.5	8.0	4200	42.0	AC	Guide	Guide	DR	5
6	Cadillac-V8.....38-60	DR	1101051	B	Yes	No	PL	5817	6.5-7.0	.....	.....	0-3.0	VR	.....	.....	.....	26.0	8.0	4550	50.0	AC	Guide	Guide	DR	6
7	Cadillac-V8.....38-65	DR	1101054	B	Yes	No	PL	5817	6.5-7.0	.....	.....	0-3.0	CVR	.....	.....	.....	26.0	8.0	4650	50.0	AC	Guide	Guide	DR	7
8	Cadillac-V8.....38-75	DR	1102652	B	Yes	No	PL	5818	6.8-7.3	.....	.....	0-3.0	CVR	.....	.....	.....	26.0	8.0	1650	17.0	AC	Guide	Guide	DR	8
9	Cadillac-Sixteen.....38-90	DR	1102651	B	Yes	No	PL	5818	6.8-7.3	.....	.....	0-2.0	CVR	.....	.....	.....	26.0	8.0	1650	17.0	AC	Guide	Guide	DR	9
10	Chevrolet-Master.....	DR	1100004	B	Yes	No	3BR	.....	6.5-7.0	800	8-9	0-3.0	VR	28.0	8.0	3400	26.5	8.0	3600	25.7	AC	Guide	Guide	DR	10
11	Chevrolet-Master De Luxe.....	DR	1100004	B	Yes	No	3BR	.....	6.5-7.0	800	8-9	0-3.0	VR	28.0	8.0	3400	26.5	8.0	3600	30.6	AC	Guide	Guide	DR	11
12	Chrysler-Royal.....C-18	AL	GDA-4801-A	B	Yes	No	Shu	.....	7.0	850	9.3	N-2.0	CVR	28.0	8.0	2000	28.0	8.0	2500	25.7	.....	CR-BR	CR-BR	.....	12
13	Chrysler-Imperial.....C-19	AL	GCO-4801-C	B	Yes	No	Shu	.....	7.0	820	9.1	N-2.0	CVR	28.0	8.0	1800	28.0	8.0	2200	19.8	.....	CR-BR	CR-BR	.....	13
14	Chrysler-Cust. Imp.....C-20	AL	GCO-4801-C	B	Yes	No	Shu	.....	7.0	820	9.1	N-2.0	CVR	28.0	8.0	1800	28.0	8.0	2200	19.8	.....	CR-BR	CR-BR	.....	14
15	De Soto.....S-5	AL	GDA-4801-A	B	Yes	No	Shu	.....	7.0	850	9.3	N-2.0	CVR	28.0	8.0	2000	28.0	8.0	2500	22.0	.....	CR-BR	CR-BR	.....	15
16	Dodge.....D-8	AL	GDA-4801-A	B	Yes	No	Shu	.....	7.0	850	9.3	N-2.0	CVR	28.0	8.0	2000	28.0	8.0	2500	22.0	.....	CR-BR	CR-BR	.....	16
17	Ford.....																								17
18	Ford.....																								18
19	Graham-Special.....	DR	848B	B	Yes	No	3BR	.....	7.0-7.5	.....	.....	0-3.0		.....	.....	.....	15-18	8.0	2900	.....	.....	.....	.....	.....	19
20	Graham-Supercharger.....	DR	1100007	B	Yes	No	3BR	5827	7.0-7.5	.....	.....	0-3.0	VR	.....	.....	.....	25-28	8.0	3600	.....	.....	.....	.....	.....	20
21	Hudson-Terraplane.....81	AL	(a)	B	Yes	No	3BR	.....	7.0	950	8.4	2.0	VR(b)	18.0	8.0	2800	17.0	8.0	2800	35.5	IL	Hall	CR-BR	Sch	21
22	Hudson-Terraplane.....82	AL	GDF-4802-A	B	Yes	No	3BR	.....	7.0	950	8.4	2.0	VR(b)	18.0	8.0	2800	17.0	8.0	2800	35.5	IL	Hall	CR-BR	SpW	22
23	Hudson-Six.....83	AL	GDF-4802-A	B	Yes	No	3BR	.....	7.0	950H	8.4	2.0	VR	30.8	8.0	3100	28.2	8.0	3200	35.5	IL	Hall	CR-BR	SpW	23
24	Hudson-Eight.....84,5,7	AL	GDF-4802-A	B	Yes	No	3BR	.....	7.0	950H	8.4	2.0	VR	30.8	8.0	3100	28.2	8.0	3200	37.0	IL	Hall	CR-BR	SpW	24
25	Hupmobile-Six.....E	AL	GDF-4804-A	B	Yes	No	.....	.....	7.0	870	9.5	N-2.0	VR	20.0	8.0	3200	28.0	8.0	3200	35.5	.....	.....	.....	.....	25
26	Hupmobile-Eight.....H	AL	GDF-4804-A	B	Yes	No	.....	.....	7.0	870	9.2	N-2.0	VR	22.0	8.0	3200	28.0	8.0	3200	33.9	.....	.....	.....	.....	26
27	La Salle-V8.....38-50	DR	918C	B	Yes	No	PL	5817	6.5-7.0	.....	.....	0-3.0	VR	29.0	.....	.....	.....	.....	4550	50.0	AC	Guide	Guide	DR	27
28	Lincoln-V-12.....	AL	GBC-4103	G	No	5.0	.....	.....	7.0	450	7.2	N-2.0	VR	22.0	8.0	1300	16.0	8.0	1500	20.0	US	.....	.....	SpW	28
29	Lincoln-Zephyr.....	Own		B	Yes	No	.....	.....	7.0	.....	10.0	3.0	3BR	26.0	.....	.....	15.0	7.0	1800	30.0	Own	.....	.....	SpW	29
30	Nash-Lafay-Mast. & Del.....3810	AL	GCM-4803-B	B	Yes	7.5	3BR	.....	7.07-.5	780	9.0	1.5-2.5	VR*	18.0	8.0	2600	18.0	8.0	2800	24.0	KS	CR-BR	CR-BR	SpW	30
31	Nash-Amb. Six.....3820	AL	GCM-4803-B	B	Yes	7.5	3BR	.....	7.0-7.5	780	9.0	1.5-2.5	VR*	18.0	8.0	2600	18.0	8.0	2800	24.0	KS	CR-BR	CR-BR	SpW	31
32	Nash-Amb. Eight.....3880	AL	GCO-4802-B	B	Yes	7.5	3BR	.....	7.0-7.5	820	9.6	1.5-2.5	VCR	28.0	8.0	1800	28.0	8.0	2200	24.0	KS	CR-BR	CR-BR	SpW	32
33	Oldsmobile-Six.....F-38	DR	1100002	B	Yes	No	3BR	5814	7.5-8.5	830	9.8	0-2.0	VR	28.5	8.0	3400	26.5	8.0	3400	36.0	AC	Guide	Guide	DR	33
34	Oldsmobile-Eight.....L-38	DR	1100002	B	Yes	No	3BR	5814	7.5-8.5	800	9.8	0-2.0	VR	28.5	8.0	3200	25.6	8.0	3400	.....	AC	Guide	Guide	DR	34
35	Packard-Six.....1600	DR	1100005	B	Yes	No	.....	5827	6.5-7.2	850	.....	0-3.0	VR	28.3	8.0	.....	26.5	8.0	3600	.....	.....	Hall	Hall	SK	35
36	Packard-Eight.....1601,2	AL	GCJ-4807-A-2	B	Yes	Yes	No	.....	7.0	710	8.9	N-2.0	VR	30.5	8.0	2500	25.5	8.0	2800	31.1	.....	Hall	Hall	SK	36
37	Packard-Super Eight.....1603,4,5	AL	GCO-4803-A	B	Yes	Yes	No	.....	7.0	800	9.8	N-2.0	VR	28.0	8.0	1800	28.0	8.0	2200	21.5	.....	Hall	Hall	SK	37
38	Packard-Twelve.....1606,7	AL	GCE-4803-A	B	Yes	Yes	No	.....	7.0	700	9.2	N-2.0	VR	30.0	8.0	1400	30.0	8.0	1600	17.4	.....	Hall	Hall	SK	38
39	Pierce Arrow.....1801	Dyn	CO-1309	B	Yes	3.0	3BR	.....	.....	.....	8-10	.....	VR	32.0	8.0	1800	28.0	8.0	2400	20-25	Mot	Guide	Guide	DR	39
40	Pierce Arrow.....1802	Dyn	CO-1309	B	Yes	3.0	3BR	.....	.....	.....	8-10	.....	VR	32.0	8.0	1800	28.0	8.0	2400	20-25	Mot	Guide	Guide	DR	40
41	Pierce Arrow.....1803	Dyn	CO-1309	B	Yes	3.0	3BR	.....	.....	.....	8-10	.....	VR	32.0	8.0	1800	28.0	8.0	2400	20-25	Mot	Guide	Guide	DR	41
42	Plymouth.....P-5	AL	GBM-4606-C-1	B	Yes	No	3BR	.....	7.0	800	10.7	N-2.0	3BR	18.0	8.0	2300	16.0	8.0	2600	25.2	.....	CR-BR	CR-BR	.....	42
43	Plymouth.....P-6	AL	GDF-4801-A	B	Yes	No	3BR	.....	7.0	870	9.5	N-2.0	VR	31.0	8.0	3200	28.0	8.0	3200	35.1	.....	CR-BR	CR-BR	.....	43
44	Pontiac-Six.....38-26DA	DR	1100003	B	Yes	No	3BR	5835	6.5-7.5	.....	.....	0-3.0	VR	28.0	8.0	3300	26.0	8.0	3300	37.0	AC	Guide	Guide	DR	44
45	Pontiac-Eight.....38-28DA	DR	1100003	B	Yes	No	3BR	5806	6.5-7.5	.....	.....	0-3.0	VR	28.0	8.0	3300	26.0	8.0	3300	37.0	AC	Guide	Guide	DR	45
46	Studebaker-Six & Com.....7A-8A	AL	GCJ-4808-A	B	Yes	5.0	3BR	.....	6.4	800	7-8	1.0	V3BR	25.0	8.0	2400	22.0	8.0	2800	25.3	Mot	CR-BR	CR-BR	DR	46
47	Studebaker-President.....4C	DR	1102653	B	Yes	5.0	3BR	5818	6.4	825	9.7	1.0	VR	26.0	8.0	1750	26.0	8.0	1750	21.1	Mot	CR-BR	CR-BR	DR	47
48	Willys.....38	AL	GAM-4505	B	No	No	3BR	.....	7.0	995	12.0	0.5-2.5	3BR	17.0	8.0	2400	12.5	8.0	2350	22.0	KS	CR-BR	CR-BR	Sch	48

ABBREVIATIONS:

*—At extra cost †—Or over
(a)—GDF 4802 with radio, GDF 4803A-1 without
(b)—With radio only
3BR—Third Brush

AL—Auto-Lite
C-3BR—Compensated Third Brush
CR-BR—Corcoran Brown
CVR—Current and Voltage regulated
Dyn—Owens-Dyneto
G—Gear H—Hot

IL—Indicating Light only
KS—King Seeley
Mot—Motometer Gauge & Equip. Co.
N—Negative or Minus
No—No or None
PL—Peak Load Type

Sch—Schwarze Shu—Shunt wound
SK—Sparton or Klaxon
SpW—Sparks Withington
SW—Stewart Warner
US—U. S. Gauge Co.
V3BR—Voltage Regulator & Third Brush
VR—Voltage Regulator

CLUTCH AND REAR AXLE

Line Number	CAR MAKE AND MODEL	CLUTCH							FACINGS					REAR AXLE														Line Number
		Make	Type	Ventilated	Power Unit—Make	Vibration Insulation	No. of Driving Discs	No. of Driven Discs	Material	Inside Diam.	Outside Diam.	Thickness	No. Required	Make	Type	Min. Road Clearance	LUBRICATION Capacity (Pts.)	GRADE Summer	GRADE Winter	GEARING Type	GEARING Ratio (Std.), 5 pass., 4 d. Sedan	No. of Teeth Ring	No. of Teeth Pinion	Pinion Adjustment	Pinion Bearing Adjust.	Pinion Bearing In Sleeve	Pinion Bearing—Preloaded	Back Lash (Average)	
1	Bantam 60	Rock	SP-SC		No	No	2	1	Mo	6.50	8 7/16	.125	2	Spi	½					SB	5.67			Shim	Shim	No	Yes		1
2	Buick-Special 38-40	O-L	SP	Yes	No	Sp	2	1	Wo	6.00	10.0	.125	2	Own	½	7 3/8	3.0*	90EP	90EP	Hyp	4.40	44	10	Shim	None	No	F	.009	2
3	Buick-Century 38-60	O-B	SP	Yes	No	Sp	2	1	Wo	6.50	11.0	.125	2	Own	½	7 1/2	3.0*	90EP	90EP	Hyp	3.90	39	10	Shim	None	No	F	.009	3
4	Buick-Roadmaster 38-80	O-B	SP	Yes	No	Sp	2	1	Wo	6.50	11.0	.125	2	Own	½	7 5/8	4.0*	90EP	90EP	Hyp	4.18	46	11	Shim	None	No	F	.009	4
5	Buick-Limited 38-90	O-B	SP	Yes	No	Sp	2	1	Wo	6.50	11.0	.125	2	Own	½	8 1/8	4.0*	90EP	90EP	Hyp	4.55	41	9	Shim	None	No	F	.009	5
6	Cadillac-V8 38-60	Long	SP-SC	No	No	Sp	2	1	Wo	6.50	11.0	.125	2	Own	½	8 1/4	5.0	APL	APL	Hyp	3.92	47	12	Shim	None	No	.....	.006	6
7	Cadillac-V8 38-65	Long	SP-SC	No	No	Sp	2	1	Wo	6.50	11.0	.125	2	Own	½	7 1/2	6.0	APL	APL	Hyp	4.58	55	12	Shim	None	No	.....	.006	7
8	Cadillac-V8 38-75	Long	SP-SC	No	No	Sp	2	1	Wo	6.50	11.0	.125	2	Own	½	8	6.0	APL	APL	Hyp	4.58	55	12	Shim	None	No	.....	.006	8
9	Cadillac-Sixteen 38-90	Long	SP-SC	No	.....	No	2	1	Wo	7.00	11.5	.125	2	Own	½	8	6.0	APL	APL	Hyp	4.31	56	13	Shim	None	No	.....	.006	9
10	Chevrolet-Master	Own	SP	No	No	Sp	2	1	Mo	6¼	9.0	.125	2	Own	½	8½	3.0	EP	EP	Hyp	3.72	41	11	STC	None	No	No	.006	10
11	Chevrolet-Master De Luxe	Own	SP	No	No	Sp	2	1	Mo	6¼	9.0	.125	2	Own	½	8½	3.0	EP	EP	Hyp	4.22	38	9	STC	None	No	No	.006	11
12	Chrysler-Royal C-18	B&B	SP	Yes	No	Sp	2	1	Wo	6.0	10.0	.125	2	Own	½	9	3¼	Spec-EP	90EP	Hyp	4.10	41	10	.....	Shim	.....	.....	.....	12
13	Chrysler-Imperial C-19	B&B	SP	Yes	No	Sp	2	1	Wo	6⅛	11.0	.125	2	Own	½	8⅝	3¼	Spec-EP	90EP	Hyp	3.91	43	11	.....	Shim	.....	.....	.....	13
14	Chrysler-Cust. Imp C-20	B&B	SP	Yes	No	Sp	2	1	Wo	6⅛	11.0	.125	2	Own	½	9 1/16	6¼	Spec-EP	90EP	Hyp	4.55	50	11	.....	Shim	.....	.....	.....	14
15	De Soto S-5	B&B	SP	Yes	No	Sp	2	1	Wo	6.0	10.0	.125	2	Own	½	8¼	3¼	Spec-EP	90EP	Hyp	4.10	41	10	.....	Shim	.....	.....	.....	15
16	Dodge D-8	B&B	SP	Yes	No	Sp	2	1	Wo	6.0	10.0	.125	2	Own	½	8¾	3¼	Spec-EP	90EP	Hyp	4.10	41	10	.....	Shim	.....	.....	.....	16
17	Ford																												17
18	Ford																												18
19	Graham-Special	Long	SC	.....	No	Sp	2	1	Mo	6.0	9.5	.125	2	Spi	½	7½				Hyp	4.27	47	11	Shim	Shim	No	.....	.....	19
20	Graham-Supercharger	Long	SC	.....	No	Sp	2	1	Mo	6.0	9.5	.125	2	Spi	½	7½				Hyp	4.27	47	11	Shim	Shim	No	.....	.....	20
21	Hudson-Terraplane 81	Own	SP-W	No	No	Sp	2	1	Cork	5.375	8.625	.203	108	Own	½	8.437	3.0	90EP	90EP	SB	4.11°	37	9	Shim	Shim	No	Yes	.002	21
22	Hudson-Terraplane 82	Own	SP-W	No	No	Sp	2	1	Cork					Own	½	8.437	3.0	90EP	90EP	SB	4.11°	37	9	Shim	Shim	No	Yes	.002	22
23	Hudson-Six 83	Own	SP-W	No	Ben	Sp	2	1	Cork	6.375	9.750	.203	108	Own	½	8.43	3.0	90EP	90EP	SB	4.11°	37	9	Shim	Shim	No	Yes	.002	23
24	Hudson-Eight 84,5,7	Own	SP-W	No	Ben	Sp	2	1	Cork	6.375	9.75	.203	108	Own	½	8.43	3.0	90EP	90EP	SB	4.11°	37	9	Shim	Shim	No	Yes	.002	24
25	Hupmobile-Six E	B&B	SP	Yes			2	1		6⅛	9⅞	.125	2	Own	½	8⅛	2¾	110EP	90EP	SB	4.54	50	11						25
26	Hupmobile-Eight H		SP				2	1		6.00	10.0	.137	2	Own	½	8.0	3½	110EP	90EP	Hyp	4.54	50	11						26
27	La Salle-V8 38-50	Long	SP-SC	No	No	Sp	2	1	Wo	6.50	10.5	.137	2	Own	½	8¼	5.0	APL	APL	Hyp	3.92	47	12	Shim	None	No	.....	.006	27
28	Lincoln V-12	Long	SP-SC	.....	No	Sp	2	1	Wo	9.00	12.0	.137	2	.....	FF	8 ¼	2½	160EP	90-110EP	SB	4.58	55	12	.....	.....	.....	.....	.010	28
29	Lincoln-Zephyr		SP-SC		No	Sp	2	1						Own		¾				Hyp	4.44								29
30	Nash-Lafay-Mast. & DeL 3810	B&B	SP	Yes	No	Sp	2	1	Wo	5⅝	9¼	.125	2	Own	½	7⅝	4.0	90EP-M	90EP-M	SB	4.11°	37	9	Shim	Shim	No	No	.007	30
31	Nash-Amb. Six 3820	B&B	SP	Yes	No	Sp	2	1	Wo	6.0	10.0	.125	2	Own	½	7¾	4.0	90EP-M	90EP-M	SB	4.11°	37	9	Shim	Shim	No	No	.007	31
32	Nash-Amb. Eight 3880	B&B	SP	Yes	No	Sp	2	1	Wo	6.0	10.0	.125	2	Own	½	8.0	6.0	90EP-M	90EP-M	SB	4.10°	41	10	Shim	Shim	No	No	.007	32
33	Oldsmobile-Six F-38	B&B	SP	Yes	No	Sp	2	1	Wo	5½	9¼	.125	2	Own	½	8⅛	2½			SB	4.37	35	8	Shim	None	No	Yes	.0065	33
34	Oldsmobile-Eight L-38	B&B	SP	Yes	No	Sp	2	1	Wo	6.00	10.00	.125	2	Own	½	8½	2½			SB	4.37	35	8	Shim	None	No	Yes	.0065	34
35	Packard-Six 1600		SP			Sp	2	1		6.00	9.5	.125	2	Own	½		6.0	Spec	Spec	Hyp	4.54	50	11					.004	35
36	Packard-Eight 1601,2		SP			Sp	2	1		6.00	10.0	.137	2	Own	½		6.0	Spec	Spec	Hyp	(a)	(b)	(c)					.004	36
37	Packard-Super Eight 1603,4,5		SP			Sp	2	1		7.00	12.0	.137	2	Own	½		6.5	Spec	Spec	Hyp	4.69	61	13					.004	37
38	Packard-Twelve 1606,7		SP			Sp	2	1		7.00	12.0	.137	2	Own	½		6.0	Spec	Spec	Hyp	4.41	75	17					.004	38
39	Pierce-Arrow 1801	Long	SP-SC	No	No	Sp	2	1	Mo	7.00	12.0	.137	2	Own	½	7⅝	6.0	90EP	90EP	Hyp	4.58	55	12	Shim	Shim	Yes	.....	.0025	39
40	Pierce-Arrow 1802	Long	SP-SC	No	No	Sp	2	1	Mo	7.00	12.0	.137	2	Own	½	7⅞	6.0	90EP	90EP	Hyp	4.58	55	12	Shim	Shim	Yes	.....	.0025	40
41	Pierce-Arrow 1803	Long	SP-SC	No	No	Sp	2	1	Mo	7.00	12.0	.137	2	Own	½	7⅞	6.0	90EP	90EP	Hyp	4.58	55	12	Shim	Shim	Yes	.....	.0025	41
42	Plymouth P-5	B&B	SP	Yes	No	Sp	2	1	Wo	5⅝	9¼	.133	2	Own	½	8¼	3¼	Spec-EP	90EP	Hyp	3.90	39	10	.....	Shim	.....	.....	.....	42
43	Plymouth P-6	B&B	SP	Yes	No	Sp	2	1	Wo	5⅝	9¼	.133	2	Own	½	8¼	3¼	Spec-EP	90EP	Hyp	4.10	41	10	.....	Shim	.....	.....	.....	43
44	Pontiac-Six 38-26DA	Own	SP	.....	.....	Sp	2	1	Mo	6.00	10.0	.125	2	Own	½	8.0	3.0	160	90	SB	4.37	35	8	Shim	Shim	No	No	.003	44
45	Pontiac-Eight 38-28DA	Own	SP	.....	.....	Sp	2	1	Mo	6.00	10.0	.125	2	Own	½	8⅛	3.0	160	90	SB	4.37	35	8	Shim	Shim	No	No	.003	45
46	Studebaker-Six & Com. 7A-8A	B&B	SP	Yes	No	Sp	2	1	WM	5⅝	9¼	.137	2	Spi	½	7½	3.0	Spec	Spec	Hyp	4.55	50	11	Shim	Shim	No	.....	.004	46
47	Studebaker-President 4C	Long	SP-SC	Yes	No	Sp	2	1	Mo	6.0	9½	.125	2	Spi	½	8.0	3.0	Spec	Spec	Hyp	4.55	50	11	Shim	Shim	No	.....	.004	47
48	Willys 38	R-B	SP	Yes	No	Sp	2	1	Mo	5⅛	7⅞	.125	2	Own	½	8¼	1¼	160	90	SB	4.30	43	10	Shim	Shim	No	.....	.007	48

ABBREVIATIONS:

*—Others also
*—Pounds instead of Pints
½—Semi Floating
¾—Three quarter floating

(a)—1601—4.36; 1602—4.70
(b)—1601—48; 1602—47
(c)—1601—11; 1602—10
APL—Approved Lubricant

B&B—Borg & Beck
EP—Extreme Pressure
F—Front only
FF—Full Floating
Hyp—Hypoid

Mo—Moulded
O-B—Own design—Borg & Beck disc
O-L—Own design—Long disc
R-B—Rockford with Borg & Beck disc
Rock—Rockford

SB—Spiral Bevel
SC—Semi Centrifugal
Sp—Springs
SP—Single Plate
Spec—Special Hypoid

Spi—Spicer
SpW—Single plate—Wet type
STC—Shms & Tapered Collar
W-M—Woven and Moulded
Wo—Woven

MECHANICAL SPECIFICATIONS

TRANSMISSION AND UNIVERSAL JOINTS

Line Number	CAR MAKE AND MODEL	Make	No. of Forward Speeds	Shifting Mechanism: Make	Shifting Mechanism: Type	AUTOMATIC OVERDRIVE: Make	Lubrication: Capacity (Pts.)	Lubrication: Grade: Summer	Lubrication: Grade: Winter	TRANSMISSION GEAR RATIOS (To—1): In High	Overdrive	Second	Low	Reverse	Constant Mesh Gears	TYPE GEARS: For Second	For First	For Reverse	Synchronous Meshing Second and Third Gears?	LUBRICATION: Capacity (Pts.)	Grade S. A. E. No.: Summer	Grade S. A. E. No.: Winter	UNIVERSAL JOINTS: Make	Number Used	Type	Lubricated With	Drive Medium	Torque Medium	Line Number
1	Bantam....60	WG	3	WG	Std	No	No	No	No	5.87	No	1.42	2.45	3.24	H,S	He	Spr	Spr	Yes				UP	2	NB	PL	Sp	Sp	1
2	Buick-Special....38-40	Own	3	Own	Std‡	No	No	No	No	4.40	No	1.66	2.94	3.78	All	He	He	He	Yes	1¾	160*	90	SUB	1	PB	Aut	TT	TT	2
3	Buick-Century....38-60	Own	3	Own	Std	No	No	No	No	3.90	No	1.53	2.39	2.39	All	He	He	He	Yes	2½	160	90	SB	1	PB	Aut	TT	TT	3
4	Buick-Roadmaster....38-80	Own	3	Own	Std	No	No	No	No	4.18	No	1.53	2.39	2.39	All	He	He	He	Yes	2½	160	90	SB	1	PB	Aut	TT	TT	4
5	Buick-Limited....38-90	Own	3	Own	Std	No	No	No	No	4.55	No	1.53	2.39	2.39	All	He	He	He	Yes	2½	160	90	SB	1	PB	Aut	TT	TT	5
6	Cadillac-V8....38-60	Own	3	Own	Std	No	No	No	No	3.92	No	1.53	2.39	2.39	H,S	He	He	He	Yes	2½	90EP	90EP	Mec	2	NB	PL	Sp	Sp	6
7	Cadillac-V8....38-65	Own	3	Own	Std	No	No	No	No	4.58	No	1.53	2.39	2.39	H,S	He	He	He	Yes	2½	90EP	90EP	Mec	2	NB	PL	Sp	Sp	7
8	Cadillac-V8....38-75	Own	3	Own	Std	No	No	No	No	4.58	No	1.53	2.39	2.39	H,S	He	He	He	Yes	2½	90EP	90EP	Mec	2	NB	PL	Sp	Sp	8
9	Cadillac-Sixteen....38-90	Own	3	Own	Std	No	No	No	No	4.31	No	1.53	2.39	2.39	H,S	He	He	He	Yes	2½	90EP	90EP	Mec	2	NB	PL	Sp	Sp	9
10	Chevrolet-Master....	Own	3	Own	Std	No	No	No	No	3.72	No	1.68	2.94	2.94	H,S	He	Spr	Spr	Yes	1¾	90	90	Own	1	PB	Aut	Sp	TT	10
11	Chevrolet-Master De Luxe....	Own	3	Own	Std	No	No	No	No	4.22	No	1.68	2.94	2.94	H,S	He	Spr	Spr	Yes	1¾	90	90	Own	1	PB	Aut	Sp	TT	11
12	Chrysler-Royal....C-18		3		Std	Yes‡	1			4.10	.722*	1.55	2.57	3.48	H,S	He	He	He	Yes	2¼	160	90	UP	2	NB	PL	Sp	Sp	12
13	Chrysler-Imperial....C-19		3		Std	Yes‡	1¼			3.91	.722*	1.52	2.53	3.16	H,S	He	He	He	Yes	3¼	160	90	UP	2	NB	PL	Sp	Sp	13
14	Chrysler-Cust. Imp....C-20		3			Yes				4.55	.704	1.52	2.53	3.16	H,S	He	He	He	Yes	6¼††	160	90	UP	2	NB	PL	Sp	Sp	14
15	De Soto....S-5		3		Std	Yes‡	1			4.10	.722*	1.55	2.57	3.48	H,S	He	He	He	Yes	2¼	160	90	UP	2	NB	PL	Sp	Sp	15
16	Dodge....D-8		3		Std	No	No	No	No	4.10		1.55	2.57	3.48	H,S	He	He	He	Yes	2¼	160	90	UP	2	NB	PL	Sp	Sp	16
17	Ford....																												17
18	Ford....																												18
19	Graham-Special....	WG	3	WG	Std	No‡	No	No	No	4.27	No	1.55	2.57	3.48	H,S	He	He	He	Yes				UP	2	NB	PL	Sp	Sp	19
20	Graham-Supercharger....	WG	3	WG	Std	No‡	No	No	No	4.27	No	1.55	2.57	3.48	H,S	He	He	He	Yes				UP	2	NB	PL	Sp	Sp	20
21	Hudson-Terraplane....81	Own	3	Ben	VE	No	No	No	No	4.11	No	1.61	2.42	2.99	S	He	Spr	Spr	No	3	90EP	90EP	Spi	2	NB	Fib	Sp	Sp	21
22	Hudson-Terraplane....82	Own	3	Ben	VE	No	No	No	No	4.11	No	1.61	2.42	2.99	S	He	Spr	Spr	No	3	90EP	90EP	Spi	2	NB	Fib	Sp	Sp	22
23	Hudson-Six....83	Own	3	Ben	VE	No	No	No	No	4.11	No	1.61	2.42	2.99	H,S	He	Spr	Spr	No	3	90EP	90EP	Spi	2	NB	Fib	Sp	Sp	23
24	Hudson-Eight....84,5,7	Own	3	Ben	VE	No	No	No	No	4.11	No	1.61	2.42	2.99	H,S	He	Spr	Spr	No	3	90EP	90EP	Spi	2	NB	Fib	Sp	Sp	24
25	Hupmobile-Six....E	WG	3	WG	Std	No	No	No	No	4.54	No	1.55	2.57	3.48									Spi	2	NB	PL	Sp	Sp	25
26	Hupmobile-Eight....H	WG	4	WG	Std	WG				4.54	.705	1.51	2.52	3.15										2	NB	PL	Sp	Sp	26
27	La Salle-V8....38-50	Own	3	Own	Std	No	No	No	No	3.92	No	1.53	2.39	2.39	H,S	He	He	He	Yes	2½	90EP	90EP	Mec	2	NB	PL	Sp	Sp	27
28	Lincoln....V-12	Own	3	Own	S'd	No	No	No	No	4.58	No	1.76	2.57	3.40	H,S	He	He	He	Yes	2½	160	90-110	Spi	1	PB	SSG	TT	TT	28
29	Lincoln-Zephyr....	Own	3	Own	Std	No	No	No	No	4.44	No	1.60	2.82	3.62	H,S	He	He	He	Yes	2½	160	90-110	Spi	1	PB	SSG	TT	TT	29
30	Nash-Lafay-Mast. & DeL....3810	Own	3	EvP‡	Vac‡	WG	3	70MO	50MO	4.11	.708	1.55	2.57	3.48	H,S	He	He	He	Yes	3½	110	90	Mec	2	NB	PL	Sp	Sp	30
31	Nash-Amb. Six....3820	Own	3	EvP‡	Vac‡	WG	3	70MO	50MO	4.11	.708	1.55	2.57	3.48	H,S	He	He	He	Yes	3½	110	90	Mec	2	NB	PL	Sp	Sp	31
32	Nash-Amb. Eight....3880	Own	3	EvP‡	Vac‡	WG	3	70MO	50MO	4.44	.708	1.55	2.57	3.48	H,S	He	He	He	Yes	3½	70MO	50MO	Mec	2	NB	PL	Sp	Sp	32
33	Oldsmobile-Six....F-38	Own	3	Own	Std	Own‡				4.37	No	1.66	2.94	3.78	H,S	He	He	He	Yes	2(d)			Mec	3	NB	PL	Sp	Sp	33
34	Oldsmobile-Eight....L-38	Own	3	Own	Std	Own‡	6			4.37	No	1.66	2.94	3.78	H,S	He	He	He	Yes	2(d)			Mec	3	NB	PL	Sp	Sp	34
35	Packard-Six....1600	Own	3	Own	Std	No	No	No	No	4.54	No	1.53	2.43	3.17		He	He	He	Yes	2	160	90	Mec	2	NB	PL	Sp	Sp	35
36	Packard-Eight....1601,2	Own	3	Own	Std	No	No	No	No	(a)	No	1.53	2.43	(c)		He	He	He	Yes	2	160	90	UP	2	NB	PL	Sp	Sp	36
37	Packard-Super Eight....1603,4,5	Own	3	Own	Std	No	No	No	No	4.69	No	1.52	2.46	2.88	H,S,L	He	He	He	Yes	4½	160	90	UP	2	NB	PL	Sp	Sp	37
38	Packard-Twelve....1606,7	Own	3	Own	Std	No	No	No	No	4.41	No	1.53	2.46	2.84	H,S,L	He	He	He	Yes	4½	160	90	UP	2	NB	PL	Sp	Sp	38
39	Pierce Arrow....1801	WG	3	WG	Std	WG	2½	90	90	4.58	.705	1.63	2.69	3.23	H,S	He	He	He	Yes	4½	90	90	UP	2	NB	PL	Sp	Sp	39
40	Pierce Arrow....1802	WG	3	WG	Std	WG	2½	90	90	4.58	.705	1.63	2.69	3.23	H,S	He	He	He	Yes	4½	90	90	UP	2	NB	PL	Sp	Sp	40
41	Pierce Arrow....1803	WG	3	WG	Std	WG	2½	90	90	4.58	.705	1.63	2.69	3.23	H,S	He	He	He	Yes	4½	90	90	UP	2	NB	PL	Sp	Sp	41
42	Plymouth....P-5	Own	3	Own	Std	No	No	No	No	3.90	No	1.55	2.57	3.48	H,S	He	He	He	Yes	2¼	160	90	UP	2	NB	PL	Sp	Sp	42
43	Plymouth....P-6	Own	3	Own	Std	No	No	No	No	4.10	No	1.55	2.57	3.48	H,S	He	He	He	Yes	2¼	160	90	UP	2	NB	PL	Sp	Sp	43
44	Pontiac-Six....38-28DA	Own	3	Own	Std	No	No	No	No	4.37	No	1.66	2.94	3.78	S	He	He	He	Yes	1¾	160	90	Mec	2	NB	PL	Sp	Sp	44
45	Pontiac-Eight....38-28DA	Own	3	Own	Std	No	No	No	No	4.37	No	1.66	2.94	3.78	S	He	He	He	Yes	1¾	160	90	Mec	2	NB	PL	Sp	Sp	45
46	Studebaker-Six & Com....7A-8A	WG	3	EvP*	Vac*	WG*	¾	70(b)	50(b)	4.55	.722	1.55	2.57	3.48	S	He	He	He	Yes	2	70(b)	50(b)	Tmp	2	Rub	None	Sp	Sp	46
47	Studebaker-President....4C	WG	3	EvP	Vac	WG	¾	70(b)	50(b)	4.55	.722	1.55	2.57	3.48	S	He	He	He	Yes	2	70(b)	50(b)	Spi	2	NB	PL	Sp	Sp	47
48	Willys....38	WG	3	WG	Std	No	No	No	No	4.30	No	1.56	2.67	3.55	S	He	Spr	Spr	Yes	1¼	160	90	UP	2	PB	Fib	Sp	Sp	48

ABBREVIATIONS:

°—SAE—140 also
•—Evans automatic shift available at extra cost on Commander
†—Automatic shifting optional
††—With overdrive
‡—Automatic at extra cost
(a)—1601—4.36; 1602—4.70
(b)—Engine Oil
(c)—1601—3.17; 1602—3.19
(d)—Pounds instead of pints
(f)—On DeLuxe Model only
Aut—Automatic—from transmission
EvP—Evans Products Co.
Fib—Fiber Grease
H—High
He—Helical
L—Low
Mec—Mechanics
MO—Motor Oil
NB—Needle Bearing
PB—Plain Bearing
PL—Permanently Lubricated
Rub—Rubber
S—Second
SB—Spicer-Buick design
Sp—Springs
Spi—Spicer
Spr—Spur
SSG—Oil, soap, soda grease
Std—Standard Type Shift
SUB—Spicer or Universal Products-Buick design
Tmp—Thompson Products
TT—Torque Tube
UP—Universal Products
Vac—Vacuum
VE—Vacuum and Electric
WG—Warner Gear

TIRES, WHEELS, SPRINGS, SHACKLES AND SHOCK ABSORBERS

Line Number	CAR MAKE AND MODEL	TIRES: Make	Size	Number of Plies	Inflation Pressure (Lb.): Front	Rear	WHEELS: Type	Make	SPRINGS: FRONT: Suspension	Radius Rods or Sway Eliminators	Type	Make	Material	Length	Width or Dia. of Coil Wire (In.)	No. of Leaves or Coils	Spring Rate (Lbs. per In.)	Shackled	SPRINGS: REAR: Suspension	Type	Make	Material	Length	Width or Dia. of Coil Wire	No. of Leaves or Coils	Spring Rate (Lbs. per In.)	Lubrication of Leaves	Spring Cover—Make	SHACKLES: FRONT: Type	Make	REAR: Type	Make	SHOCK ABSORBERS: Make	Type	Line Number
1	Bantam.....60	Firestone	5.00/15	4	18	20	SD	MW	Tr	No	Tr	Bur		29	1½		300		Con	½E	Bur		42½	1½		110		No		Own		Own	Own	DA	1
2	Buick-Special.....38-40	US-Fir	6.50/16	4	23	28	SD	MW	Ind	SE	C	Own	9260	14½F	.648	7¼	95°	No	CC	C	Own	9260	18¾	.615	8½	150	No	No	No	No	No	No	Del	DA	2
3	Buick-Century.....38-60	US-Fir	7.00/16	4	23	28	SD	MW	Ind	SE	C	Own	9260	14¼F	.660	7¼	103°	No	CC	C	Own	9260	19F	.615	8½	150	No	No	No	No	No	No	Del	DA	3
4	Buick-Roadmaster.....38-80	US-Fir	7.00/16	4	25	30	SD	MW	Ind	SE	C	Own	9260	14¾F	.692	7½	117°	No	CC	C	Own	9260	18¾F	.635	8⅝	170	No	No	No	No	No	No	Del	TD	4
5	Buick-Limited.....38-90	US-Fir	7.50/16	6	25	30	SD	MW	Ind	SE	C	Own	9260	14¾F	.703	7½	130°	No	CC	C	Own	9260	18½F	.648	9	.....	No	No	No	No	No	No	Del	TD	5
6	Cadillac-V8.....38-60	US-Fir	7.00/16	4	26	26	SD	KH	Ind	SE*	C		9260					No	Con	½E	Eat	9260	54½	2	9	.....	WIL	.....	No	No	Thd	PM	.....	.....		6
7	Cadillac-V8.....38-65	US-Fir	7.50/16	4	28	28	SD	KH	Ind	SE*	C		9260					No	Con	½E	Eat	9260	62	2¼	9	.....	WIL	.....	No	No	RT	PM	.....	.....		7
8	Cadillac-V8.....38-75	US-Fir	7.50/16	6	32	32	SD	KH	Ind	SE*	C		9260					No	Con	½E	Eat	9260	62	2¼	11	.....	WIL	.....	No	No	RT	PM	.....	.....		8
9	Cadillac-Sixteen.....38-90	US-Fir	7.50/16	6	32	32	SD	KH	Ind	SE*	C		92€0					No	Con	½E	Eat	9260	62	2¼	10	.....	WIL	.....	No	No	RT	PM	.....	.....		9
10	Chevrolet-Master.....	Various	6.00/16	4	26	28	SA	Own	Con	No	½E	Own	CCS	36	1¾	9	.....	F	Con	½E	Own	CCS	49	1¾	8	129	Gra	No	No	Own	Th	Own	DR	SA	10
11	Chevrolet-Master De Luxe.....	Various	6.00/16	4	26	28	SA	Own	Ind	No	C	Own	CCS	9 11/16	.693	.....	1520	No	Con	½E	Own	CCS	49	1¾	8	129	Gra	Var	Th	Own	Th	Own	DR	(g)	11
12	Chrysler-Royal.....C-18	Goodyear	6.25/16	4	28	28	SD	MW	Ind	SE	C		Amo					No	Con	½E		Amo	53⅝	1¾	9	.....		Met	No	No	Th-U			DA	12
13	Chrysler-Imperial.....C-18	Goodyear	6.50/16	4	28	28	SD	MW	Ind	SE*	C		Amo					No	Con	½E		Amo	53⅝	1¾	11	.....		Met	No	No	Th-U			DA	13
14	Chrysler-Cust. Imp.....C-20	Goodyear	7.50/16	6	28	28	SD	MW	Ind	SE*	C		Amo					No	Con	½E		Amo	53⅝	2¼	11	.....		Met	No	No	Th-U			DA	14
15	De Soto.....S-5	Goodyear	6.00/16	4	28	28	SD	MW	Ind	SE	C		Amo					No	Con	½E		Amo	53⅝	1¾	9	.....		Met	No	No	Th-U			DA	15
16	Dodge.....D-8	Goodyear	6.00/16	4	24	30	SD	MW	Con	SE	½E		Amo	37	1¾	10	.....	F	Con	½E		Amo	53⅝	1¾	9	.....		Met	Th-U		Th-U			DA	16
17	Ford.....																																			17
18	Ford.....																																			18
19	Graham-Special.....		6.00/16	4	.....	.....	SD	.....	Con	SE	½E	.....	Amo	38	1¾	.....	.....	F	Con	½E	.....	Amo	53	1¾	.....	.....	.....	.....	Ru	Eat	Ru	Eat	Del	DA	19
20	Graham-Supercharger.....		6.50/16	4	.....	.....	SD	.....	Con	SE	½E	.....	Amo	38	1¾	.....	.....	F	Con	½E	.....	Amo	53	1¾	.....	.....	.....	.....	Ru	Eat	Ru	Eat	Del	DA	20
21	Hudson-Terraplane.....81	Goodyear	6.00/16	4	24	32	SA	MW	Con	SE	½E	E-M	Mo-65	33	1.75	8	110	F-R	Con	½E	E-M	Mo-65	52.5	1.75	9	110	CG	No	Th-U	PM	Th-U	PM	Mon	DA	21
22	Hudson-Terraplane.....82	Goodyear	6.00/16	4	24	32	SA	MW	Con	SE	½E	E-M	Mo-65	33	1.75	8	110	F-R	Con	½E	E-M	Mo-65	52.5	1.75	9	110	CG	Own	Th-U	PM	Th-U	PM	Mon	DA	22
23	Hudson-Six.....83	Goodyear	6.00/16	4	24	32	SA	MW	Con	SE	½E	E-M	Mo-65	37.5	1.75	9	110	F-R	Con	½E	E-M	Mo-65	52.5	1.75	9	110	CG	OF	Th-U	PM	Th-U	PM	Del	DA	23
24	Hudson-Eight.....84,5,7	Goodyear	6.50/16	4	24	32	SA	MW	Con	SE	½E	E-M	Mo-65	37.5	1.75	9	110	F-R	Con	½E	E-M	Mo-65	52.5	1.75	9	110	CG	OF	Th-U	PM	Th-U	PM	Del	DA	24
25	Hupmobile-Six.....E		6.25/16	4	24	28	SD	.....	Con	.....	½E	.....	.....	42	1¾	.....	185	.....	Con	½E	.....	.....	54	1¾	.....	120	.....	Met	.....	Th-U	.....	Gab	DA	25
26	Hupmobile-Eight.....H		6.50/16	4	26	26	SD	.....	Con	.....	½E	.....	.....	43 3/32	2	.....	185	.....	Con	½E	.....	.....	64	2	.....	120	.....	Met	.....	Th-U	.....	Gab	DA	26
27	La Salle-V8.....38-50	US, Fir	7.00/16	4	26	26	SD	KH	Ind	SE*	C	Own	9260						Con	½E	Eat	9260	54½	2	9	.....	Wil	.....	No	No	Th	PM	.....	.....		27
28	Lincoln.....V-12		7.50/17	6	40	40	SD	.....	Con	RS	½E	.....	.....	42	2¼	.....	.....	.....	Con	½E	.....	.....	62	2½	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	28
29	Lincoln-Zephyr.....	Own	7.00/16	4	28	28	SD	.....	Tr	.....	½E	Own	.....	42½	.....	.....	.....	.....	Con	½E	Own	.....	46½	.....	.....	.....	.....	.....	.....	.....	.....	.....	Hou	DA	29
30	Nash-Lafay-Mast. & DeL...3810	Goodyear	6.00/16	4	28	28	SD	Budd	Con	SE (f)	½E	SS	SM	43	1¾	13‡	.....	F	Con	½E	SS	SM	54	1¾	(f)	.....	Lub	No	Th-U	PM	Th-U	PM	D-G	SA	30
31	Nash-Amb. Six.....3820	Goodyear	6.25/16	4	27	27	SD	Budd	Con	SE	½E	SS	SM	43	2¼	10‡	.....	F	Con	½E	SS	SM	54	1¾	10	.....	Lub	No	Th-U	PM	Th-U	PM	D-G	SA	31
32	Nash-Amb. Eight.....3880	Goodyear	7.00/16	4	28	28	SD	Budd	Con	SE	½E	SS	SM	43	2¼	10‡	.....	F	Con	½E	SS	SM	54	1¾	10	.....	Lub	B&S	Th-U	PM	Th-U	PM	D-G	SA	32
33	Oldsmobile-Six.....F-36	Various	6.50/16	4	24	28	Stl	Var	Ind	.....	C	Own	SM	.....	.632	.....	295	No	Con	½E	Own	SM	54½	2	7	120	.....	And	No	No	Th-U	Own	Del	DA	33
34	Oldsmobile-Eight.....L-36	Various	7.00/16	4	24	24	Stl	Var	Ind	.....	C	Own	SM	.....	.648	.....	325	No	Con	½E	Own	SM	54½	2	8	128	.....	And	No	No	Th-U	Own	Del	DA	34
35	Packard-Six.....1600	Various	6.50/16	4	22	23	SD†	MW	Ind	SR	C	Own	SM	.....	.650	8.4	1575	No	Con	½E	.....	SM	54	2	.....	.....	.....	No	No	No	.....	.....	Del	DA	35
36	Packard-Eight.....1601,2	Various	7.00/16	4	(a)	(b)	SD†	MW	Ind	SR	C	Own	SN	.....	.660	8.4	(c)	No	Con	½E	.....	SM	54	2	.....	.....	.....	No	No	No	.....	.....	Hou	DA	36
37	Packard-Super Eight....1603,4,5	Various	7.50/16	6	24	27	SD†	MW	Ind	SR	C	Own	SM	.....	.650	9¾	(d)	No	Con	½E	.....	SM	58	2	.....	.....	.....	Met	No	No	.....	.....	Del	DA	37
38	Packard-Twelve.....1606,7	Various	8.25/16	6	26	27	SD	MW	Ind	SR	C	Own	SM	.....	.675	8 11/16	2325	No	Con	½E	.....	SM	60½	2¼	.....	.....	.....	Met	No	No	.....	.....	Del	DA	38
39	Pierce Arrow.....1801	Various	7.00/17	6	35	35	Wir.	KH	Con	No	½E	SP	SM	44	2¼	16	240	R	Con	½E	SP	SM	64	2½	9	130	Gd	And	BB	Faf	BB	Faf	Hou	DA	39
40	Pierce Arrow.....1802	Various	7.50/17	6	35	35	Wi.e	KH	Con	No	½E	SP	SM	44	2½	16	240	R	Con	½E	SP	SM	64	2½	9	130	Gd	And	BB	Faf	BB	Faf	Hou	DA	40
41	Pierce Arrow.....1803	Various	7.50/17	6	35	35	Wire	KH	Con	No	½E	SP	SM	44	2½	16	240	R	Con	½E	SP	SM	64	2½	9	130	Gd	And	BB	Faf	BB	Faf	Hou	DA	41
42	Plymouth.....P-5	Goodyear	5.50/16	4	32	32	SD	MW	Con	No	½E		Amo	37	1¾	8	.....	F	Con	½E		Amo	53⅝	1¾	7	.....		No	Th-U		Th-U			DA	42
43	Plymouth.....P-6	Goodyear	6.00/16	4	24	30	SD	MW	Con	Yes	½E		Amo	37	1¾	10	.....	F	Con	½E		Amo	53⅝	1¾	9	.....		No	Th-U		Th-U			DA	43
44	Pontiac-Six.....38-26DA	US, Fir, Gr	6.00/16	4	25	30	Stl	KH	Ind	No	C	Own	SM	14	.....	.....	90	No	Con	½E	Own	SCM	54	2	8	126	Gra	Met	No	No	Th	Own	DL	(e)	44
45	Pontiac-Eight.....38-26DA	US, Fir, Gr	6.50/16	4	25	30	Stl	KH	Ind	No	C	Own	SM	14	.....	.....	90	No	Con	½E	Own	SCM	54	2	8	.....	Gra	Met	No	No	Th	Own	DL	(e)	45
46	Studebaker-Six & Com....7A-8A	Firestone	6.00/16	4	30	30	SD	Budd	Ind	No	½E-Tr	Own	SM	48	2½	14	215	....	Con	½E	Own	SM	54	1¾	9	127	Gra	A-A	No	No	Th-U	PM	Hou	DA	46
47	Studebaker-President.....4C	Firestone	6.50/16	4	30	30	SD	Budd	Ind	No	½E-Tr	Own	SM	48	2½	15	230	....	Con	½E	Own	SM	54	1¾	10	130	Gra	A-A	No	No	Th-U	PM	Hou	DA	47
48	Willys.....38	Gyr, Seib	5.50/16	4	28	28	SD	KH	Con	No	½E	Mat	CV	33	1¾	7	180	R	Con	½E	Mat	CV	46	1¾	6	110	Gra	No	Th-U	.....	Th-U	.....	.....	.....	48

ABBREVIATIONS

°—At Wheel
*—Front and Rear
†—Artillary Type optional
‡—Plus Rebound Leaf
½E—Semi Elliptic
(a)—1601-22; 1602-24
(b)—1601-23; 1602-27
(c)—1601-1620; 1602-1890
(d)—1603-1750; 1604-5-1850
(e)—Front, Two way; Rear, direct acting
(f)—Master 8; DeLuxe 10
(g)—Single acting Front; Double Acting Rear
A-A—Anderson-Ajax
Amo—"Amola" Steel
And—Anderson
BB—Ball Bearing
Bur—Burton
B&S—Briggs & Stratton
C—Coil
CC—Conventional with Coil Springs
CCS—Chrome Carbon Steel
CG—Chassis Grease
Con—Conventional
CV—Chrome Vanadium
DA—Double Acting
Del—Delco
D-G—Delco or Gabriel
D-L—Delco-Lovejoy
Eat—Eaton
E-M—Eaton or Mather
F—Free Length
Faf—Fafnir
Fir—Firestone
Gab—Gabriel
Gd—Gredag No. 32
Gr—Goodrich
Gra—Graphite
Gyr—Goodyear
Hou—Houdaille
Ind—Independent
KH—Kelsey Hayes
Lub—Lubriplate No. 110
Mat—Mather
Met—Metal
Mo-65—Mola No. 65 Steel
Mon—Monroe
MW—Motor Wheel
O-F—Own-Fabric
PM—Pressed Metals
R—Rear
RS—Radius Rods, front; Sway Eliminator, rear
RT—Rubber and Threaded
Ru—Rubber
SA—Steel-Artillery Type
Seib—Seiberling
SCM—Silica or Chrome Manganese
SD—Steel Disc
SE—Sway Eliminator
SM—Silico-Manganese
SP—Spring Perch
SR—Stabilizers Rear Only
SS—Standard Steel Spring Co.
Stl—Steel
TD—Transport Type-Double Acting
Th—Threaded
Tr—Transverse
U—"U" Type
WIL—Wax Impregnated Liners

STEERING, FRONT AXLE, BRAKES

Line No.	CAR MAKE AND MODEL	STEERING: Steering Gear—Make	Linkage—Type	No. of Turns of Wheel for Left to Right Swing	Car Turning Radius (Minimum) (Ft.)	Caster—(Deg.)	Camber—(Deg.)	Toe-in—(Inches)	Kingpin Inclination (Deg.)	Diameter of Steering Wheel	FRONT AXLE: Make	Section Type	End Type	Minimum Road Clearance	FOOT BRAKE: Make	Type	Power Unit—Make	Type Lining	Drum: Material	Drum: Diameter	Lining: Length per Wheel	Lining: Width	Lining: Thickness	Clearance: Toe	Clearance: Heel	Total Breaking Area	Per Cent Braking on Rear	HAND BRAKE: Operates on	In-or External	Drum Diameter	Lining: Length per Drum	Lining: Width	Lining: Thickness	Lining: Clearance	Line No.
1	Bantam 60	Lav	Con	3	15	5	½	0°–9′	11½	15	Spi	I		7 11/16	Own	Mec	No	½M	Stl	8	17	1 1/16	1/16			76.0	50.0	RS	In	8	17	1 1/16	1/16		1
2	Buick-Special 38-40	Sag	CR	4½	39	N 7/16–± 3/16	N¼–P1	0–1/16	3½–4½	18	No	No	No	7 13/16	Own	Hy	No	WM	Cen	12	22 11/16	1 3/4	1/16	.010	.010	158.7	47.0	RS	In	12	22 11/16	1 3/4	1/16	.010	2
3	Buick-Century 38-60	Sag	CR	4½	42	N 7/16–± 3/16	N¼–P1	0–1/16	3½–4½	18	No	No	No	7 13/16	Own	Hy	No	WM	Cen	12	22 11/16	2	1/16	.010	.010	181.4	47.0	RS	In	12	22 11/16	2	1/16	.010	3
4	Buick-Roadmaster 38-80	Sag	CR	5	44	N 7/16–± 3/16	N¼–P1	0–1/16	4¼–5¼	18	No	No	No	7 7/16	Own	Hy	No	WM	Cl	12	22 11/16	2	1/16	.010	.010	181.4	47.4	RS	In	12	22 11/16	2	1/16	.010	4
5	Buick-Limited 38-90	Sag	CR	5	48	N 7/16–± 3/16	N¼–P1	0–1/16	4–5	18	No	No	No	8½	Own	Hy	No	WM	Cl	14	26 11/16	2	1/4	.010	.010	214.6	47.4	RS	In	14	26 11/16	2	1/4	.010	5
6	Cadillac-V8 38-60	Sag	CP			N¾–0	¼–1	1/32–3/32	4°–51′	18	No	No	No		Ben	Hy	No	Mo	Com	12	25 7/16	2	1/16	.010	.010	220.0	45.5	RS	In	12	25 7/16	2	1/16	.010	6
7	Cadillac-V8 38-65	Sag	CP			0–± ¼	0–½	1/32–3/32	5°–38′	18	No	No	No		Ben	Hy	No	Mo	Com	12	25 7/8	2 1/2	1/16	.010	.010	246.0	45.5	RS	In	12	25 7/8	2 1/2	1/16	.010	7
8	Cadillac-V8 38-75	Sag	CP			0–± ¼	0–½	1/32–3/32	5°–38′	18	No	No	No		Ben	Hy	No	Mo	Com	14	(a)	2 1/4	1/4	.010	.010	258.0	43.0	RS	In	14	30	2 1/4	1/4	.010	8
9	Cadillac-Sixteen 38-90	Sag	CP			0–± ¼	0–½	1/32–3/32	5°–38′	18	No	No	No		Ben	Hy	No	Mo	Com	14	(a)	2 1/4	1/4	.010	.010	258.0	43.0	RS	In	14	30	2 1/4	1/4	.010	9
10	Chevrolet-Master	Own	Con		19¼	1¾–2¾	½–1½	1/8–1/16	7½–± 1	17 1/16	Own	I	RE	8 5/16	Own	Hy	No	½M	Cen	11	22 5/16	1 3/4	1/16	(n)	(n)	158 1/4	47.5	RS	In	11	22 5/16	1 3/4	1/16	(n)	10
11	Chevrolet-Master De Luxe	Own	Con		19¼									10 3/16	Own	Hy	No	Mo	Cen	11	22 5/16	1 3/4	1/16	(n)	(n)	158 1/4	47.5	RS	In	11	22 5/16	1 3/4	1/16	(n)	11
12	Chrysler-Royal C-18		D-TR			½–2½	N¼–P1½	0–1/8	4¾–6	18	No	No	No	10 3/4	LH	Hy	No	Mo	Cen	11	18 3/4	2	1/16	.006	.012	150.0		DS	Ex	6	17 1/16	2	1/16	.025	12
13	Chrysler-Imperial C-19		D-TR			½–2½	N¼–P1½	0–1/8	4¾–6	18	No	No	No	11	LH	Hy	No	Mo	Cen	12	21 5/8	2	1/16	.006	.012	172.5		DS	Ex	6	17 1/16	2	1/16	.025	13
14	Chrysler-Cust. Imp C-20		CR			1–3	N¼–P1½	0–1/8	4¾–6	18½	No	No	No	9 7/8	LH	Hy	Yes	Mo	Cen	14	25 3/32	2 1/4	1/4	.006	.012	225.8		DS	Ex	7	21 1/32	2 1/2	1/16	.025	14
15	De Soto S-5		D-TR			½–2½	N¼–P1½	0–1/8	4¾–6	18	No	No	No	10 1/2	LH	Hy	No	Mo	Cl	11	18 3/4	2	1/16	.006	.012	150.0		DS	Ex	6	17 1/16	2	1/16	.025	15
16	Dodge D-8		Con			1–3	¼–¾	0–1/8	4½–5½	17		Tu	RE	8½	LH	Hy	No	Mo	Cl	11	18 3/4	2	1/16	.006	.012	150.0		DS	Ex	6	17 1/16	2	1/16	.025	16
17	Ford																																	17
18	Ford																																	18
19	Graham-Special	Ross	Con			3–4	1	1/8	7½	17	Spi	I	RE			Hy	No	Mo	Cl	11	23	1 3/4	1/4	.010	.006	241.7	50.0	DS	Ex	6	17 3/4	2	1/16	.031	19
20	Graham-Supercharger	Ross	Con			3–4	1	1/8	7½	17	Spi	I	RE			Hy	No	Mo	Cl	11	23	1 3/4	1/4	.010	.006	241.7	50.0	DS	Ex	6	17 3/4	2	1/16	.031	20
21	Hudson-Terraplane 81	Gem	Con	4.18	40′–5″	2–3	1–1½	0–.125	7.0	17	Own	I	E	8.56	Ben	Hy	No	Mo	Als	10.06	22.12	1.75	.218	.010	.010	154.8	50.0	RS	In	10.06	22.12	1.75	.218	.010	21
22	Hudson-Terraplane 82	Gem	Con	4.18	40′–5″	2–3	1–1½	0–.125	7.0	18	Own	I	E	8.56	Ben	Hy	No	Mo	Als	10.06	22.12	1.75	.218	.010	.010	154.8	50.0	RS	In	10.06	22.12	1.75	.218	.010	22
23	Hudson-Six 83	Gem	Con	4.18	42.5	2–3	1–1½	0–.125	7.0	18	Own	I	E	8.56	Ben	Hy	No	Mo	Als	10.06	22.12	1.75	.218	.010	.010	154.8	50.0	RS	In	10.06	22.12	1.75	.218	.010	23
24	Hudson-Eight 84,5,7	Gem	Con	4.18	40.5	2–3	1–1½	0–.125	7.0	18	Own	I	E	8.56	Ben	Hy		Mo	Als	11.06	23.93	1.75	.218	.010	.010	167.5	50.0	RS	In	11.06	23.93	1.75	.218	.010	24
25	Hupmobile-Six E				22	1½				18		I	RE	7½	No	Hy	No	Mo	Cl	10		2				166.0	45.0	RS	In	10		2			25
26	Hupmobile-Eight H				22	1½	1¼			18		I	RE	7 5/8	No	Hy	No	Mo	Cl	12		2				201.0	45.0	RS	In	12		2			26
27	La Salle-V8 38-50	Sag	CP	4½		N¾–0	¼–1	1/32–3/32	4°–51′	18	No	No	No		Ben	Hy	No	Mo	Com	12	25 7/8	2 1/4	1/16	.010	.010	220.0	45.5	RS	In	12	25 7/8	2 1/4	1/16	.010	27
28	Lincoln V-12	Own	Con	4.33	(t)	1½	1	1/16–1/8		18.6	Own	I	RE	8.0		Mec	Yes	Mo	Cla							330.0			In						28
29	Lincoln-Zephyr	Own	Con		22						Own	I	RE			Mec	No											4W	In						29
30	Nash-Lafay-Mast. & DeL. 3810	Gem	Con	3.1	21′–9″	1½	1½	0	7.0	18	Own	I	RE	7 5/8	Ben	Hy	No	WM	Cl	10 1/16	(r)	2	1/32	.010	.010	(s)	47.0	RS	In	10 1/16	(r)	2	1/32	.010	30
31	Nash-Amb. Six 3820	Gem	Con	3.1	21′–9″	1½	1½	0	7.0	18	Own	I	RE	7¾	Ben	Hy	No	WM	Cl	10 1/16	22	2	1/32	.010	.010	176.0	47.0	RS	In	10 1/16	22	2	1/32	.010	31
32	Nash-Amb. Eight 3880	Gem	Con	3.48	22′–7½″	1½	1½	0	7.0	18	Own	I	RE	7 5/8	Ben	Hy	No	WM	Cl	11 1/16		2 1/4	1/32	.010	.010	215.8	47.0	RS	In	11 1/16		2 1/4	1/32	.010	32
33	Oldsmobile-Six F-38	Sag	CP	2	18½	0–N¾	½–1	1/16–1/8	4°–51 1/16′	18	No	No	No		Var	Hy	No	MW	Cl	11	21 1/16	1 3/4	1/16			146.0	45.0	RS	In	11	21 1/16	1 3/4	1/16		33
34	Oldsmobile-Eight L-38	Sag	CP	2	20	0–N¾	½	1/16–1/8	4°–51 1/16′	18	No	No	No		Var	Hy	No	MW	Cl	12	23.05	1 3/4	1/16	.010	.010	162.0	45.0	RS	In	12	23.05	1 3/4	1/16	.010	34
35	Packard-Six 1600	Own	CP		21	1 1/32–1/2	½ ± 1/32	0–± 1/16	1°–54′	18	No	No	No			Hy	No	(f)	Cen	11	24	1 3/4	1/16			168.0		RS	In	11	24	1 3/4	1/16		35
36	Packard-Eight 1601,2	Own	CP		(b)	1 1/32–1/2	½ ± 1/32	0–± 1/16	1°–54′	18	No	No	No			Hy	No	(g)	Cen	12	26	(k)	1/16			(e)		RS	In	12	26	(k)	1/16		36
37	Packard-Super Eight 1603,4,5	Own	CP		(c)	2 1/32–1/2	1 ± ¼	1/16 ± 1/16	1°–30′	18½	No	No	No			Hy	No	(h)	Cen	12	26	2 1/2	1/16			260.0		RS	In	12	26	2 1/2	1/16		37
38	Packard-Twelve 1606,7	Own	CP		(d)	0–½	1 ± ¼	1/16 ± 1/16	1°–30′	18½	No	No	No			Hy	Yes	(i)	Cen	14	30	2 3/4	1/4			330.0		RS	In	14	30	2 3/4	1/4		38
39	Pierce Arrow 1801	Ross	Con	3 3/4	(p)	1	1	1/4	8.0	19	Own	I	RE	7.0	SW	Mec	Ben	Mo	CS	16	38	2 1/4	1/4	.009	.012	342.0	45.0	4W	In	16	38	2 1/4	1/4		39
40	Pierce Arrow 1802	Ross	Con	3 3/4	(q)	1	1	1/4	8.0	19	Own	I	RE	7.0	SW	Mec	Ben	Mo	CS	16	38	2 1/4	1/4	.009	.012	342.0	45.0	4W	In	16	38	2 1/4	1/4		40
41	Pierce Arrow 1803	Ross	Con	3 3/4	(q)	1	1	1/4	8.0	19	Own	I	RE	7.0	SW	Mec	Ben	Mo	CS	16	38	2 1/4	1/4	.009	.012	342.0	45.0	4W	In	16	38	2 1/4	1/4		41
42	Plymouth P-5		Con			3–5	½–¾	0–1/8	4½–5½	17		Tu	RE	7 13/16	LH	Hy	No	Mo	Cen	10	17 13/16	2	1/16	.006	.012	138.4		DS	Ex	6	17 1/16	2	1/16	.025	42
43	Plymouth P-6		Con			1–3	¼–¾	0–1/8	4½–5½	17		Tu	RE	8½	LH	Hy	No	Mo	Cen	10	17 13/16	2	1/16	.006	.012	138.4		DS	Ex	6	17 1/16	2	1/16	.025	43
44	Pontiac-Six 38-26DA	Sag	D-TR		38′–5″	N¾–N1¼	¾–1¼	0	4°–51 1/16′	18	No	No	No		Ben	Hy	No	Mo	CNI	12	23 1/16	1 3/4	1/16	.010	.010	161.0	48.0	RS	In	12	23 1/16	1 3/4	1/16	.010	44
45	Pontiac-Eight 38-28DA	Sag	D-TR		39′–5″	N¾–N1¼	¾–1¼	0	4°–51 1/16′	18	No	No	No		Ben	Hy	No	Mo	CNI	12	23 1/16	1 3/4	1/16	.010	.010	161.0	48.0	RS	In	12	23 1/16	1 3/4	1/16	.010	45
46	Studebaker-Six & Com. 6A-7A	Ross	DA	4	41′–3″	N¼–P½	½N	1/8–1/32	5½	18	No	No	No		LH	Hy	No	WM	BC	11	19 1/16	2	1/16	.010	.005	150.0	45.0	RS	In	11	19 1/16	2	1/16	(m)	46
47	Studebaker-President 4C	Ross	DA	4¾	42′–4″	N¼–P½	½N	1/8–1/32	5½	18	No	No	No		LH	Hy	No	WM	BC	11	19 1/16	2 1/4	1/16	.010	.005	169.0	45.0	RS	In	11	19 1/16	2 1/4	1/16	(m)	47
48	Willys 38	Gem	CP		17.0	3	2	1/32	7½	17	Own	I	RE	7 1/2	Ben	Hy	Ho	Mo	1020	9	19 1/16	1 3/4	1/16	.010	.010	134.3	55.0	4W	In	9	19 1/16	1 3/4	1/16	.010	48

ABBREVIATIONS:

½M—Semi Moulded
4W—Four Service Brakes
(a)—Front 27¼; Rear 30
(b)—1601—21½; 1602—26½
(c)—1603—22; 1604—23¼; 1605—23¾
(d)—1607—24; 1608—24½
(e)—1601—182.0; 1602—232.0
(f)—Primary No. 714, Secondary No. 589—U. S. Asbestos
(g)—Primary No. 451, Raybestos No. 589—U. S. Asbestos
(h)—Primary No. 1035, secondary No. 600—Marshall Asb. Co.
(j)—Primary No. 451—Raybestos, Secondary No. 589 U. S. Asb.
(k)—1601—1¾; 1602—2¼
(m)—Toe .010; Heel .005
(n)—Adjust to slight drag, back off 4 notches
(p)—138 W.B.—23′-3″; 144 W.B.—24′-1″
(q)—138 W.B.—23′-3″; 144 W.B.—24′-1″; 147 W.B.—24 -9″
(r)—Master 21.0; De Luxe 22.0
(s)—Master 168.0; De Luxe 168.0 or 176.0
(t)—136 W.B.—24; 145 W.B.—26

Als—Alloy Steel
BC—Budd Composite
Ben—Bendix
Cen—Centrifuse
Cl—Cast Iron
Cla—Cast Iron Alloy
CNI—Chrome Nickel Iron
Com—Composite
CP—Center Point
CR—Cross Linkage
CS—Carbon Steel
DA—Direct Action
DS—Drive Shaft
DTr—Dual Tie Rod
E—Elliot
Ex—External
Gem—Gemmer
Hy—Hydraulic
I—"I" Beam Type
Lav—Lavine
LH—Lockheed Hydraulic
Mec—Mechanical
Mo—Moulded
M-W—Primary-Moulded; Secondary-Woven
N—Negative
P—Positive
RE—Reverse Elliot
RS—Rear Service Brakes
Sag—Saginaw
Tu—Tubular
Var—Various
W-M—Primary-Woven; Secondary-Moulded

Just Among Ourselves

Now that the Picture Differs—

SEVERAL months ago, we were criticized rather sharply for not playing a steam calliope in the tourist trailer parade to prosperity. We said then, as we maintain now, that the ballyhoo about the industry was less important than the solid foundation it hoped to build. Now as the foundation begins to emerge, it is found that too much publicity carried its own rebound mechanism wrapped up in it. Here is a letter to us from Philip H. Smith, who wrote the trailer story in this issue. It tells the whole story:

"Trailer makers charge that the press has played a major role in bringing trouble on to the industry. Briefly the criticism is this:

"Publishing stories that producers could not keep up with demand and that a new, big industry had been launched, is responsible for encouraging vast numbers of incompetents to enter the business, leading to intense competition, price cutting and a general lowering of standards.

"Spreading the idea that millions of people were going to purchase trailers; that trailer cities would spring up and that a new type of living was in the making, has frightened municipal authorities into passing extreme and uncalled for legislation, and has aroused the animosity of other groups engaged in catering to the tourist.

"Probably these charges are all true, but is the trailer industry in a position to complain? The press published the words, ideas and hopes of the manufacturers. It merely acted as a mouthpiece without the exercise of censorship. When AUTOMOTIVE INDUSTRIES made its survey last year there were less than a dozen producers who realized that publicity could strangle as well as nurture, and that same select few alone were interested in a factual, interpretive story. The rest, the present complainers, sought only to 'turn on the heat.'

"The press can do the industry a great service, but not in the role of goat."

One Man's Remedy Another's Poison

ONE way of curing a sore throat is to drink carbolic acid. This is merely another way of stating that methods of curing an undesirable condition may be worse than the condition itself. As a principle, we believe it applies to such things as the wage and hour legislation which is to be the primary concern of the special session of Congress convened by Presidential proclamation.

Much similar legislation passed in state legislatures within the last year has had the unfortunate effect of penalizing industries which have been operating without the evils the legislation is designed to correct.

Who would maintain, for example, that there is a child-labor problem anywhere in the automotive industries? Yet our industry will have to bear far more than its proportionate share of the burdens following on legislation intended to eliminate child labor.

Most sections of the automotive industry are admittedly in a good position so far as its wage and hour schedules are concerned. Yet the cost of materials which go into cars will rise all along the line from mine to factory—if Federal wage and hour legislation is put into effect.

Even before the pioneering studies of J. Russell Smith it was pretty well understood that economics was very often a matter of geography. What of the penalties which will strike one section as against another if blanket Federal legislation is put into effect?

Suppose the latter point is recognized. If a Federal board were appointed to set up schedules varying with locality and regional standards, it would, as the National Association of Manufacturers points out, take probably a decade to put the whole plan into effect.

Recent events have shown that seven years of business uncertainty can cause untold suffering to the workers of a nation. That Congress would deliberately plunge the country into such another period of uncertainty is unthinkable—but possible.

The country is in the midst of a great and laudable campaign to stamp out venereal disease. Plans for attacking it are admirably specific. Diseases of the social fabric, such as child labor, can be cured with remedies as specific. It isn't necessary to "purge" all industry in order to do it.

A Lot Between the Covers

IN this issue of AUTOMOTIVE INDUSTRIES, keynoted as it is on the word "Achievement," there are some unobtrusive facts which may be worth noting. The physical size of the issue—not so unobtrusive in itself—is considerably in advance of last year's comparable issue, and there are more pages for readers. Business wise the issue helps to swell our October advertising schedules to the largest single month since 1930.—H. H.

(t)—136 W.B.—24; 145 W.B.—26 GP—Center Point

Mechanical Ingenuity Boosts 1938

By Joseph Geschelin

THE familiar story of plant modernization and improved production techniques is being repeated for the 1938 model season—with some variations that emphasize the increasingly important part played in the automotive scheme by the equipment manufacturers.

As each year rolls by we note the marvels of mechanical ingenuity expressed in every phase of the production process. Yet each new year brings fresh wonders that lead us to speculate upon the untapped reservoirs that seemingly gush without end under the stimulating influence of automotive executives.

It may be a platitude to say that there is no set formula for the solution of production problems. We have discussed, on occasion, the place of special machines, of unit type machines, and of universal equipment. Although the scene shifts constantly, each type of process continues to have its place in varying degrees. If there is any definite trend in this respect, it is to greater flexibility of action and change.

Several new plants, under construction at the time this article was being prepared, indicate the changing viewpoint and emphasis upon the social values in a manufacturing organization. We have found occasion during the past few years to note the things being done to improve worker comfort and make things more pleasant for the operators. In these respects, the new plants—those that will be in full swing some time after the turn of the year—have gone as far as our knowledge of the social values extends at the present time.

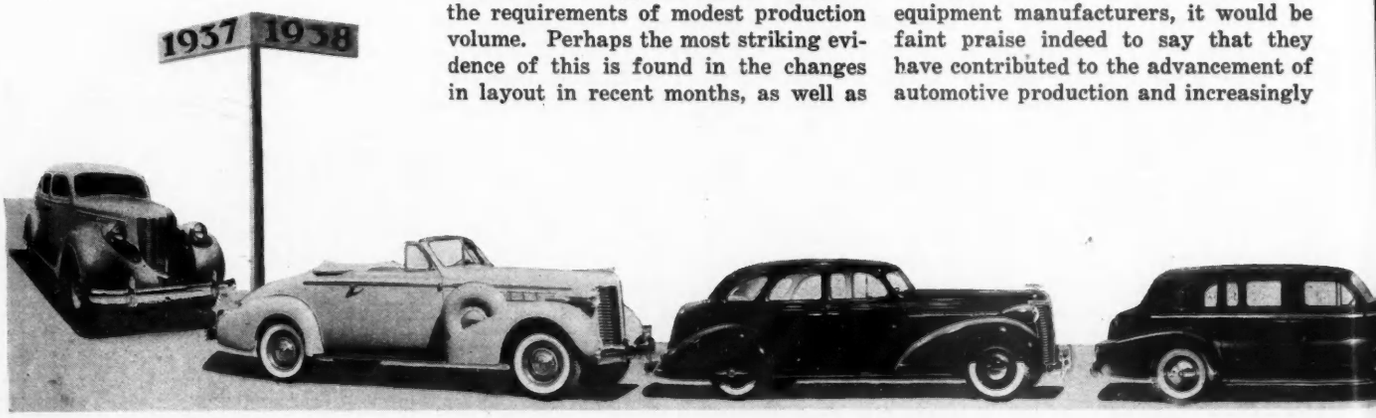
What we have in mind is the conscious use of motion-study techniques in their widest application. It encompasses the elimination of fatigue by the utilization of every conceivable kind of materials-handling device—slides, belts, monorail; as well as the coordination of these devices with assembly stations and work places of convenient height for a specific operation. Probably the best example of what we mean is a new automotive hardware and trim plant now under construction which carries mechanization to a degree hitherto unapproached. In the planning of work lines, in the development of machine layout and materials handling, in the role of the worker—in all these steps, the predominating idea is worker comfort and elimination of fatigue. Let it be noted that the social objective has resulted in a plant layout which increases productivity 23 per cent as compared with the best plants now in operation.

Those of our readers who have followed our monthly series on the manufacturing plants of the industry must be impressed with the fact that even the smaller units are taking advantage of the most modern methods, insofar as they may be applied economically to the requirements of modest production volume. Perhaps the most striking evidence of this is found in the changes in layout in recent months, as well as in the adoption of materials-handling devices that eliminate manual effort in varying degree.

Automotive foundries, in particular, have made the most significant strides in decades, in improving procedures and eliminating the back-breaking effort associated with foundry practice from time immemorial. This has been achieved by the adoption of automatic and semi-automatic molding machines; by investment in conveyorized pouring and molding lines; and by the generous installation of materials handling devices. Despite the tremendous investment involved in air-conditioning systems for foundries, some of the larger units already have started the installation of air-washers and most foundries have made provision to draw off fumes and dust on all pouring lines and shake-out stations.

With the passing of overhead belt drives and the increasing use of individual machine drives, there has come an industry-wide swing to the modern power wiring systems in which the overhead power lines thread the production departments and offer conveniently and frequently-spaced power outlets for the machines. This has struck the shackles on machinery positioning and freedom of movement of machines. No longer do machines stay put where originally installed. It is a simple matter today to shift machines at will either within a given line or within a given department or even to an entirely different department.

When it comes to the role of the equipment manufacturers, it would be faint praise indeed to say that they have contributed to the advancement of automotive production and increasingly



8 Production Lines to Higher Utility

Worker comfort, materials handling, simplified machine operations, heat treating, have all been aimed at higher planes of quality, productivity and economy.

higher levels of quality at constantly lower costs. We give you just one example—the new $4,000,000 plant put up by Buick for the production of the new self-shifting transmission.[1]

Here was the case of an entirely new mechanism on which there was no previous history so far as production technique goes. The very nature of the design demanded many precision operations, comprising — precision boring, precision facing, and precision indexing. All of the production study was done prior to putting up the building. It was a case of living with the job for almost a year, just in the blueprint stage. During this interval, the plant manager consulted with the master mechanic's department and made frequent trips to plants making somewhat similar products.

Finally, the rough routings were submitted, together with blueprints of the parts, to those machinery builders who were most likely to be familiar with the specific operations. They were asked to study the parts and suggested routings. Then they were asked to submit their own recommendations as to routing changes and the design of special machines and tooling.

When the returns came in, they were carefully studied by the Buick production men. Finally, certain manufacturers were asked to submit definite bids and recommendations based upon further consultation and the working out of an acceptable compromise.

Surely this may be taken as a classic example of the role of the machinery manufacturer in the automotive scheme of things.

[1] Described for the first time in AUTOMOTIVE INDUSTRIES, Sept. 11, 1937.

With the foregoing summary of the bright spots of the production picture, we intend to cover most briefly some of the recent improvements and advances in the relatively familiar processes.

Surface broaching today is a well established production process and is rapidly expanding its natural field of usefulness. Suffice it to say that many very difficult and relatively costly operations involving the finishing of small or large surfaces, either flat or contoured, may be done rapidly and at much lower cost wherever the surface broaching technique is economically applied.

Grinding of every kind—cylindrical, surface, internal, etc., has been vastly improved both with respect to productivity and quality.

Perhaps the biggest strides have been made in gear production, particularly for transmission gears what with the emphasis on fine finish, extremely close tolerances on form and dimensions, and the requirement of quietness. For most practical purposes, it may be said that transmission gear production resolves itself into a method of rough and finish cutting, correction of tooth profile in the green with no further finishing or varied in some cases with lapping or grinding after heat treatment. Shaving is not used where there is a lapping or grinding after heat treatment. Moreover, grinding is little used today on passenger car transmissions although it has a very definite place for the time being on the larger gears.

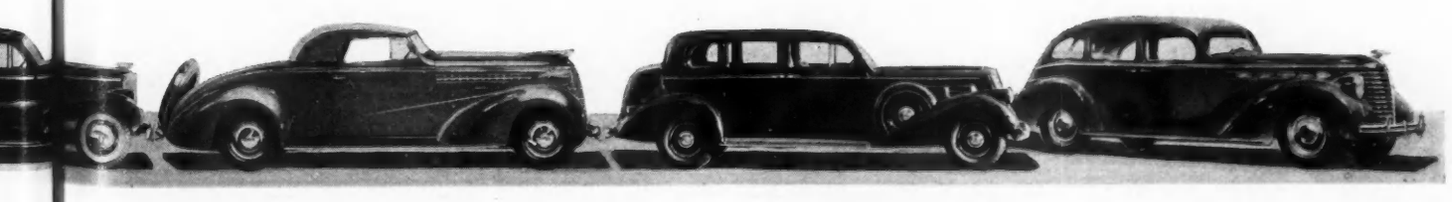
Hobbing machines are used for roughing or finishing depending upon the type of gear and the character of the process. The Gould & Eberhardt 8-spindle hobber is finding a wide field of usefulness where mass-production may be expedited.

Similarly, the familiar gear shaper is widely used for rough and finish gear cutting. The biggest contribution made by Fellows in recent years is its new high-speed gear shaper which fits well into the mass-production scheme.

Gear shaving is one of the most valuable processes introduced in recent years. It is widely used for finishing and correcting gear tooth profile in the green, thus eliminating all finishing operations after heat treatment. The equipment most widely used for this purpose is made by Michigan Tool Co., and the National Broach & Machine Co.

Gear lapping is used after heat treatment on many of the larger sized transmission gears, and almost invariably for internal gears. Familiar equipment

(Turn to page 625, please)



The Metal Industry's P

TWO HUNDRED AND THIRTY-TWO companies paraded their latest product developments at the Nineteenth National Metal Exposition and National Metal Congress held Oct. 18-22, in the huge auditorium at Atlantic City, N. J. The number of exhibitors broke all records for the annual show, sponsored this year by the American Society for Metals in cooperation with the American Welding Society, American Institute of Mining and Metallurgical Engineers, American Society of Mechanical Engineers, and the Wire Association.

Events held concurrently with the show included, on the A.S.M. program, presentation of 43 technical papers and a series of educational lectures. The latter were given on two major topics: "Open-Hearth Steel Making," by Earnshaw Cook, American Brake Shoe and Foundry Co., and "Metallographic Technique," by J. R. Vilella, United States Steel Corp.

The program of the American Welding Society consisted of seven sessions during which 25 papers were delivered. Subjects discussed included industrial and fundamental research in welding, fabrication, alloy steels, and welding problems related to shipbuilding and railroads. Total number of engineering papers submitted by members of the five cooperating societies amounted to 109.

Among the newest equipment developments exhibited was the electro-magnetic fatigue testing machine shown by Baldwin-Southwark Corp. of Philadelphia. Named the Rayflex, this device was developed by Dr. A. V. DeForest of the Massachusetts Institute of Technology.

With the Rayflex machine exhibited at the show it is possible to make fatigue tests of specimens in sizes ranging from ¼ in. up to 1 in. in diameter or thickness, and lengths from 1 ft. to 3 ft. The unit can also accommodate flat stock in widths up to 5 in.

Principle of operation of the device is that of vibrating the test specimen at its natural period, the specimen being supported at two nodes or points of no motion. Load is applied at the ends of the specimen by means of electromagnets actuated from an oscillator-amplified combination. The frequency of this driving source is controlled by the specimen and automatically follows its changes in frequency. By operating in this manner, the required power is only that necessary to supply the energy dissipated during the stress cycle. This amount of power varies with the damping capacity of the material and, as stated by Baldwin-

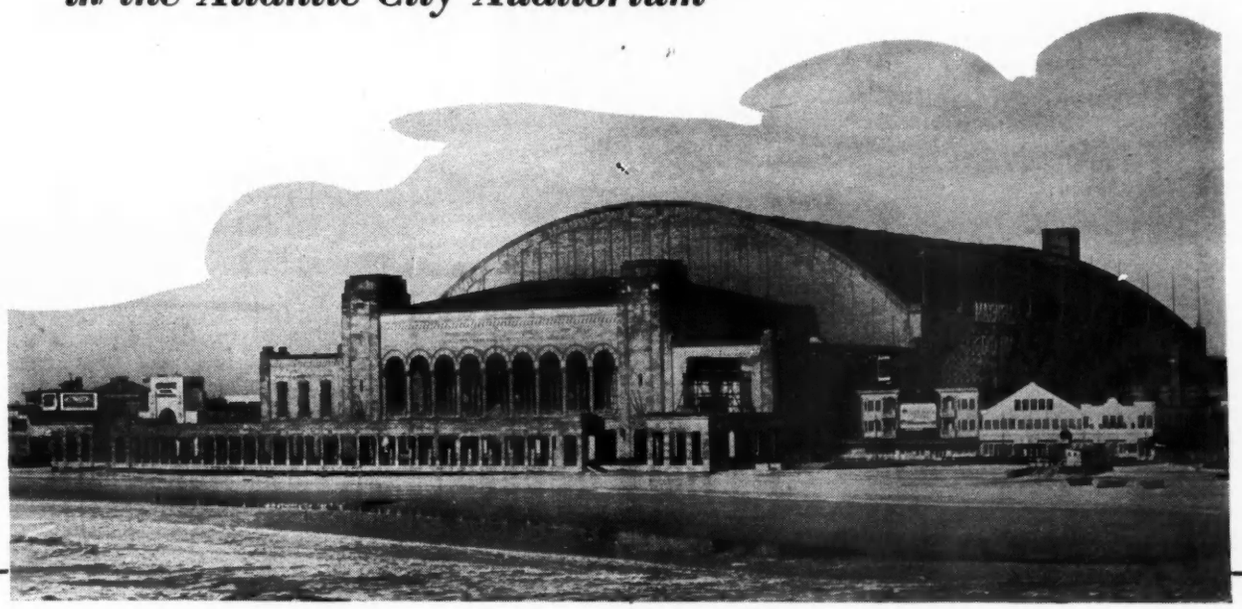
(*Turn to page 202 in the advertising section, please*)

Exhibitors at the 19th National Metal Exposition

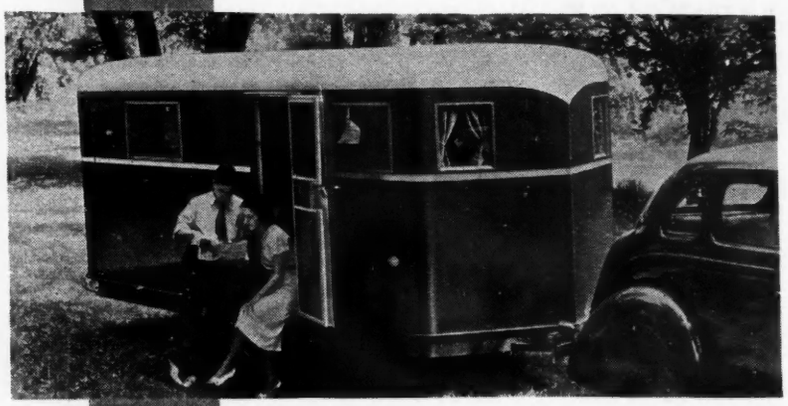
Air Reduction Sales Co.
Ajax Electric Co., Inc.
Ajax Electrothermic Corp.
Allegheny Steel Co.
Alox Corp.
Aluminum Co. of America
The American Brass Co.
American Bridge Co.
American Car and Foundry Co.
American Coach & Body Co.
American Crucible Co.
American Cyanamid & Chemical Corp.
American Electric Furnace Co.
The American Foundry Equipment Co.
American Gas Association
American Gas Furnace Co.
American Institute of Mining & Metallurgical Engineers
American Machinist and Product Engineering
American Metal Market
American Rolling Mill Co.
American Screw Co.
American Society for Metals
American Steel & Wire Co.
American Welding Society
Ampco Metal, Inc.
Anchor Drawn Steel Co.
Anderson & Sons
Arcos Corp.
Armstrong Cork Products Co.
Audubon Wire Cloth Corp.
Automatic Gasflux, Inc.
Automatic Temperature Control Co., Inc.
Automotive Industries
The Babcock & Wilcox Co.
Baker & Co.
Baldwin-Southwark Corp.
Barrett-Cravens Co.
The Bastian Blessing Co.
Bausch & Lomb Optical Co.
The Bellis Heat Treating Co.
Bethlehem Steel Co.
G. S. Blakeslee & Co.
Bonney Forge & Tool Works
Botfield Refractories Co.
The Bristol Co.
The Brown Instrument Co.
Adolph I. Buehler
Burdett Manufacturing Co.
Andrew C. Campbell Division, American Chain & Cable Co., Inc.
Carboloy Company, Inc.
The Carborundum Co.
Carnegie-Illinois Steel Corp.
Chapman Valve Mfg. Co.
Climax Molybdenum Co.
Colonial Steel Co.
Columbia Steel Co.
Continental Machine Specialties, Inc.
Crown Rheostat & Supply Co.
Crucible Steel Co. of America
Cyclone Fence Co.
Cyclops Steel Co.
Daily Metal Trade
A. P. de Sanno & Son, Inc.
Despatch Oven Co.
Detroit Rex Products Co.
Detroit Testing Machine Co.
Henry Disston & Sons, Inc.
Joseph Dixon Crucible Co.
The Dow Chemical Co.
Driver-Harris Co.
E. I. du Pont de Nemours & Co., Inc.
Eclipse Fuel Engineering Co.
Eisler Engineering Co.
Electric Arc Cutting & Welding Co.
The Electric Furnace Co.
The Electro Alloys Co.
Electro Metallurgical Co.
Electro Refractories & Alloys Corp.
Elevator Supplies Co., Inc.
Ensign-Reynolds, Inc.
Federal Products Corp.
Firth-Sterling Steel Co.
Florence Pipe Foundry & Machine Co.
The J. B. Ford Sales Co.
The Foxboro Co.
The Gas Machinery Co.
Gehnrich & Gehnrich
General Alloys Co.
General Electric Co.
General Electric X-Ray Corp.
Globar Div., Carborundum Corp.
Grob Brothers
Holcomb Steel Co.
Handy & Harman
Harnischfeger Corp.
Hauck Manufacturing Co.
C. I. Hayes, Inc.
Haynes Stellite Co.
Heller Brothers Co.
Hevi Duty Electric Co.
Hobart Brothers Co.
A. F. Holden Co.
Hollup Corp.
Charles A. Hones, Inc.
E. F. Houghton & Co.
Illinois Testing Laboratories, Inc.
Illinois Tool Works
Industrial Heating
The Industrial Press
Industrial Publishing Co.
Industrial Steel Casting Co.
The International Nickel Co.
The Iron Age
Jessop Steel Co.
Johns-Manville
Jones & Laughlin Steel Corp.
The C. M. Kemp Mfg. Co.
Krouse Fatigue Machine Co.

Panorama of Progress

. . . . . *many new developments shown publicly for first time at 19th Annual National Metal Exposition in the Atlantic City Auditorium*

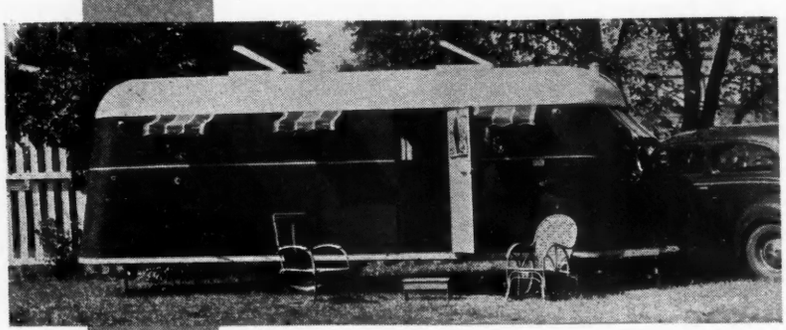


Lebanon Steel Foundry
Leeds & Northrup Co.
E. Leitz, Inc.
Lepel High Frequency Laboratories, Inc.
The Lewis Machine Co.
The Lincoln Electric Co.
Lindberg Engineering Co.
The Linde Air Products Co.
Los Angeles Chamber of Commerce
Ludlum Steel Co.
Maas & Waldstein Co.
Machine Design
Macklin Co.
Magnaflux Corp.
Magnetic Analysis Corp.
Mahr Manufacturing Co.
Manhattan Rubber Manufacturing Div.
Marburg Brothers, Inc.
Maurath, Inc.
The McKay Co.
Metal & Thermit Corp.
Metal Cleaning and Finishing
Metal Industry Publishing Co., Inc.
Metal Progress
Metals and Alloys
Metals Coating Company of America
Metlab Co. (Metallurgical Laboratories, Inc.)
Michigan Steel Casting Co.
A. Milne & Co.
Modern Machine Shop and Products Finishing
Molybdenum Corp. of America
Morrison Engineering Co., Inc.
The Mullite Refractories Co.
National Carbide Corp.
National Cylinder Gas Co.
National Gas Furnace Co.
National Industrial Publishing Co.
National Tube Co.
The New Jersey Zinc Co.
Norton Co.
The Ohio Crankshaft Co.
Tinius Olsen Testing Machine Co.
Owen Electric Sales Co.
Page Steel and Wire Div. American Chain & Cable Co.
Pangborn Corp.
Paramount Oilless Bearing Co., Inc.
Park Chemical Co.
Parker-Kalon Corp.
The Partlow Corp.
Henry Pels & Co.
The Penton Publishing Co.
George F. Pettinos, Inc.
The Philadelphia Drying Machinery Co.
Horace T. Potts Co.
H. P. Preis Engraving Machine Co.
Product Engineering
Production Machine Co.
Products Finishing
The Pyle-National Co.
Pyro-Electro Instrument Co.
The Pyrometer Instrument Co.
Quigley Company, Inc.
Republic Steel Corp.
Riehle Testing Machine Division American Machine and Metals, Inc.
The Riverside Metal Co.
The Stanley P. Rockwell Co.
John A. Roebling's Sons Co.
Roxalin Flexible Lacquer Co.
Rustless Iron & Steel Corp.
Joseph T. Ryerson & Son, Inc.
Safety Gas Lighter Co.
George Scherr Co.
F. E. Schundler & Co., Inc.
Scully Steel Products Co.
The Selas Co.
The Sentry Co.
Shakeproof Lock Washer Co.
Shenango-Penn Mold Co.
Sleeper & Hartley, Inc.
A. O. Smith Corp.
Spencer Turbine Co.
Steel
Steel City Testing Laboratory
Steel Publications, Inc.
Stoody Co.
D. A. Stuart Oil Co.
Surface Combustion Corp.
Syncro Machine Co.
C. J. Tagliabue Mfg. Co.
Taylor-Hall Welding Corp.
Tenn. Coal, Iron & Railroad Co.
Thermal Products Corp.
The Timken Roller Bearing Co.
The Titanium Alloy Mfg. Co.
The Torrington Mfg. Co.
Una Welding, Inc.
Union Carbide Co.
Unitcast Corp.
United States Steel Corp. Subsidiaries
Universal-Cyclops Steel Corp.
Vanadium-Alloys Steel Co.
Vanadium Corp. of America
Victor Saw Works, Inc.
The Welding Engineer Publishing Co.
Wells Manufacturing Corp.
Westinghouse Electric & Manufacturing Co.
Wheelco Instruments Co.
Wiedemann Machine Co.
The H. A. Wilson Co.
Wilson Mechanical Instrument Co., Inc.
Wilson Welder and Metals Co., Inc.
Wire Association
The Youngstown Sheet and Tube Co.
Carl Zeiss, Inc.



Master, de luxe, and custom coach designate Covered Wagon's three regular offerings for 1938. Body lengths are 14 ft., 17 ft., and 20 ft. respectively.

This is the Palace Travel Coach, Master Model 38.



The Schult Homestead model.

A LITTLE more than a year ago Philip H. Smith was sent by AUTOMOTIVE INDUSTRIES to make a study of the tourist trailer industry. The resulting article established him as one of the few realists writing about the industry. Subsequent opportunities were provided for Mr. Smith to make a special study of the legislative and social aspects of the tourist trailer. Apart from an S.A.E. paper or two, his findings have been reported exclusively in AUTOMOTIVE INDUSTRIES. The present article is the result of credit studies and a field survey. Constructive in tone, it does not wink at unpalatable truths.

By PHILIP H. SMITH

NINETEEN HUNDRED AND THIRTY SEVEN will be recorded in trailer history as the year of the great shake-down.

The explosion, which shattered many manufacturers to bits and left others partially maimed, came a little sooner than anticipated; but, since it had to come, the industry is much the better for having it over. Realities now take precedent over dreams, and with feet firmly planted on something solid the industry can now begin to build substantially.

Many of the uncertainties which occupied attention last year when AUTOMOTIVE INDUSTRIES published its survey have been cleared up, or are in process of being settled beyond doubt. As a result the direction of future development is somewhat clarified and this, too, is beneficial.

A quick skimming reveals several facts coming out of this year's experience. These are:

Production will equal, but not substantially exceed that of 1936. . . approximately.

Automobile dealers are not good outlets for tourist trailers.

Automobile companies will not engage in trailer manufacture.

There is no sweep towards the use of metal for body panels.

Trailers are not a solution to low-cost housing problems.

Babson's prophecy of a trailer-housed population is no nearer fulfillment.

In view of the fact that all forecasts called for a doubling or tripling of production in 1937, the failure to exceed the 1936 output by any appreciable amount comes as a sharp surprise and calls for quite a lot of explanation.

Seventeen thousand sounds like a very small number of trailers, but all previous forecasts were figured from

Present Realities

in the Tourist Trailer Industry

a grossly inflated base. The year began with a good deal of drive but sales fell off drastically in the second quarter and there has not yet been any appreciable increase. Just why this slump nobody knows, because it wasn't any single factor, but a number of them which contributed to the decline. Here are some of them:

Strikes.

Adverse local ordinances.

Competition and price cutting.

Wearing off of the effects of artificial stimulus.

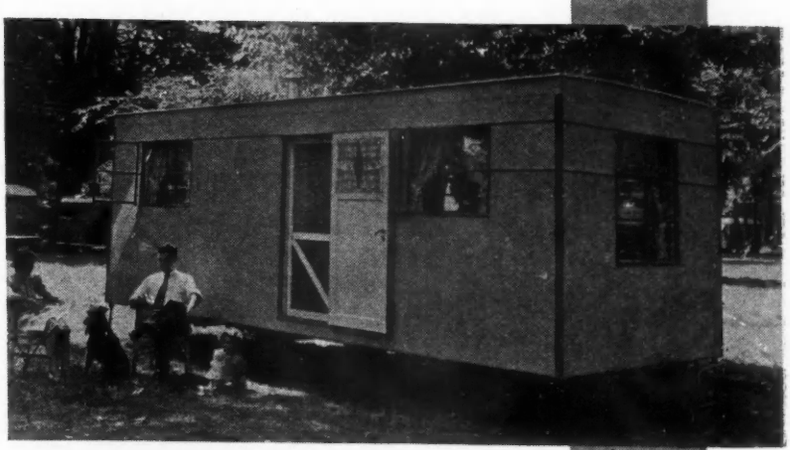
Strikes affected sales in the major industrial cities, from which, after all, a large number of sales are drawn. The industrial worker who purchased a trailer to relieve the pressure of high rent or housing shortage, hesitated to undertake the financial obligation. When he was bold enough to go ahead with a trailer purchase the finance companies decided he was a poor risk and ended the matter with dispatch.

Local ordinances which hedged the trailer around with restrictions have had a very detrimental effect on sales. Would-be purchasers decided to hold off until they knew exactly how and where the trailer could be used. Trailer manufacturers report a large number of sales either cancelled or postponed indefinitely on this one account. State legislation, on the other hand, has not been onerous. Such rules and regulations as have been promulgated have been fair and directed toward making the trailer a safe vehicle rather than toward squelching its development.

The question as to whether use of a trailer to live in and the removal of its wheels make of it a real estate proposition has yet to be settled, and until it is settled the finance companies will not look approvingly on the trailer industry as a source of business.

Competition has intensified as the result of multiplication of trailer manu-

Warner Electric brakes are available on all 1938 Covered Wagon models of which another is shown above.



Covered Wagon's "cottage" model is an experiment in housing. Mounted on a steel chassis, this model combines the mobility of a trailer with interior space characteristics which make it more adaptable to permanent living-on-wheels.

facturers. Urged by the promise of immediate and easy profits, new companies sprang up all over the country to swell the number of producers to something like 800. Few of these new concerns produced any sizeable quantity, but the aggregate was enough to whittle away business from the established manufacturer. If anyone doubts this expansion of manufacture they need only take an automobile trip through the State of Michigan and see the trailer company signs gracing the private-house-and-garage combination of the back-yard tinkerer.

The effect of this heightened competition combined with a falling off of demand has been to bring about price-cutting. Dealers, and not a few producers, faced with a slow moving inventory, have been willing to sell at cost or even below cost to move the goods. This has had a very demoralizing effect on both seller and buyer. At the same time, the necessity for turning these inventories into cash, maintained production even after demand had declined, and we find a great deal of distress merchandise on the market which will require many months to clean up and which will penalize the sound producer who gives value and must get a satisfactory price to remain sound.

If we say that the trailer industry has been operating under the stimulus of the "needle" and that its effects have worn off we have one more bit of evidence of the "why" of sales decline. It just couldn't go on indefinitely. Blowing up the trailer as a commodity which would bring heaven into family life created a grossly one-sided picture. It also favored the manufacture and sale of a vast amount of merchandise that wouldn't stand up. Naturally, the people who never should have bought in the first place have been disillusioned and even the fans have had their measure of disappointment. When troubles arose, some quite legitimate, others unwarranted, the owners squawked loudly and the more loudly because of what they had been led to believe about the millennium arriving. This was bad promotion and will take time to live down, for, as in a chain letter, the disillusioned person passes his complaint to anyone who will listen.

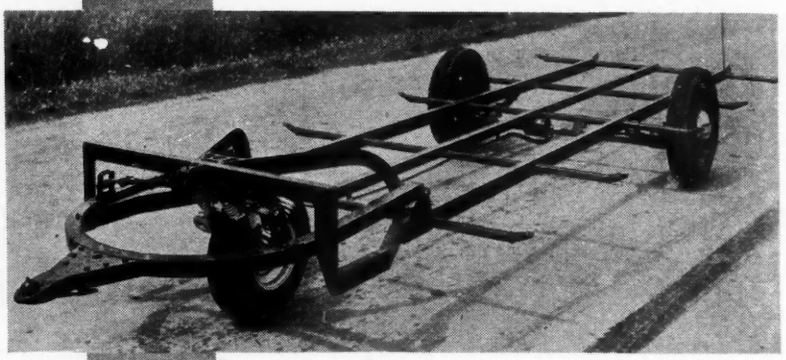
Of course, all this hits the capable producer with the same force that it does the fly-by-night manufacturer. He labors under someone else's cloud, not the least of which is the chilly attitude of the finance companies.

Automobile dealers are not going to provide the outlet for trailer production. The industry is almost unanimous in declaring that the automobile salesman has fallen down as a merchandiser and that the specialty salesman will have to do the job. Justly, or unjustly, the verdict is that automobiles today are sold very largely through factory effort; that this has made the salesman little more than an order-taker and that what is needed is real merchandising and constant plugging. Experiments will be tried with new outlets. The use of fairs rather than shows will be tried. Certainly filling stations are out of the picture and the demand is now for show-rooms and some adornment.

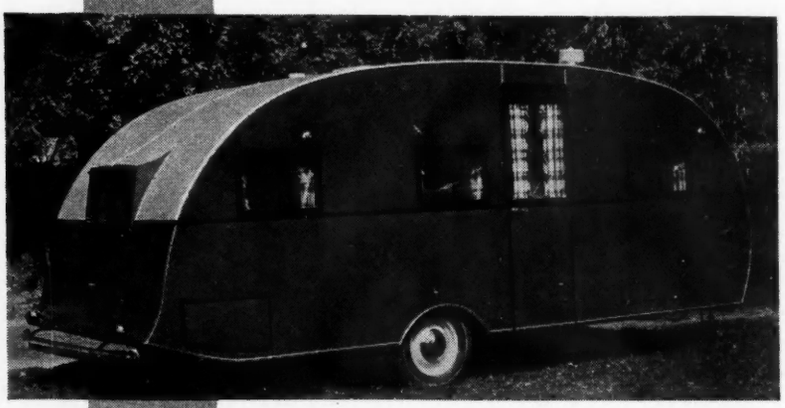
The time draws near when the 1938 models will be unveiled to public gaze. What will these new models be like and at what price will they be offered? Nothing radical is in the offing. Producers have their new stuff far enough along to make this certain. In a shake-down year it takes a bold operator to depart from the conservative path, and since it is those alone who operated conservatively in the past who have any capital left to play with, it will be the tried, known and proven in 1938. New models are generally backward about appearing because of the distress merchandise awaiting disposal and because there are inventories to be worked off.

Last year a sweep to the use of metal for exterior panels was heralded, but

(Turn to page 606, please)

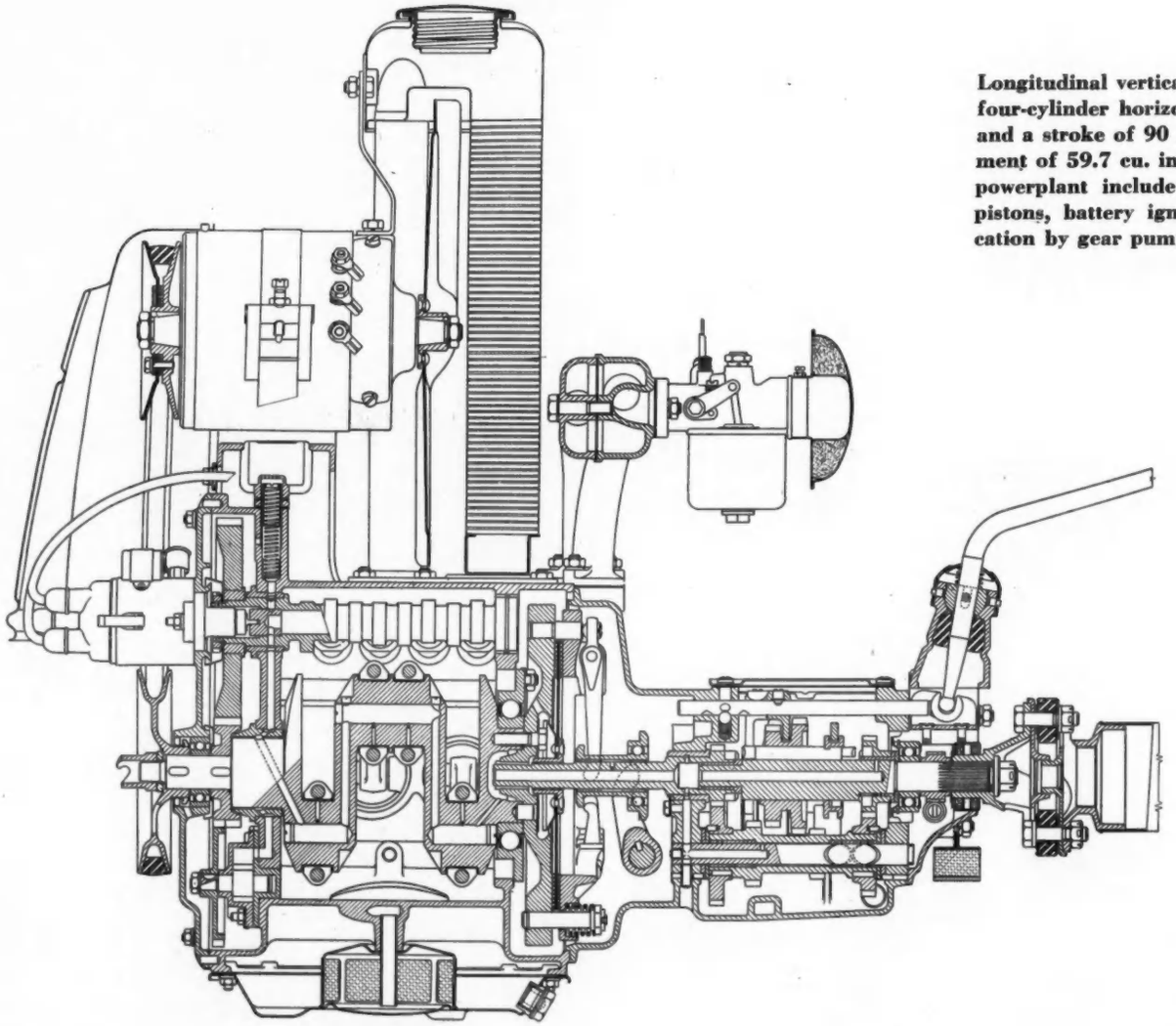


Self-aligning third wheel and wishbone couple construction developed by the Saginaw Stamping & Tool Co.



A 1938 model of the Alma Trailer Co. Inside dimensions: 21 ft., 5 in. by 6 ft., 9 in.

Steyr 50 Powerplant . . .

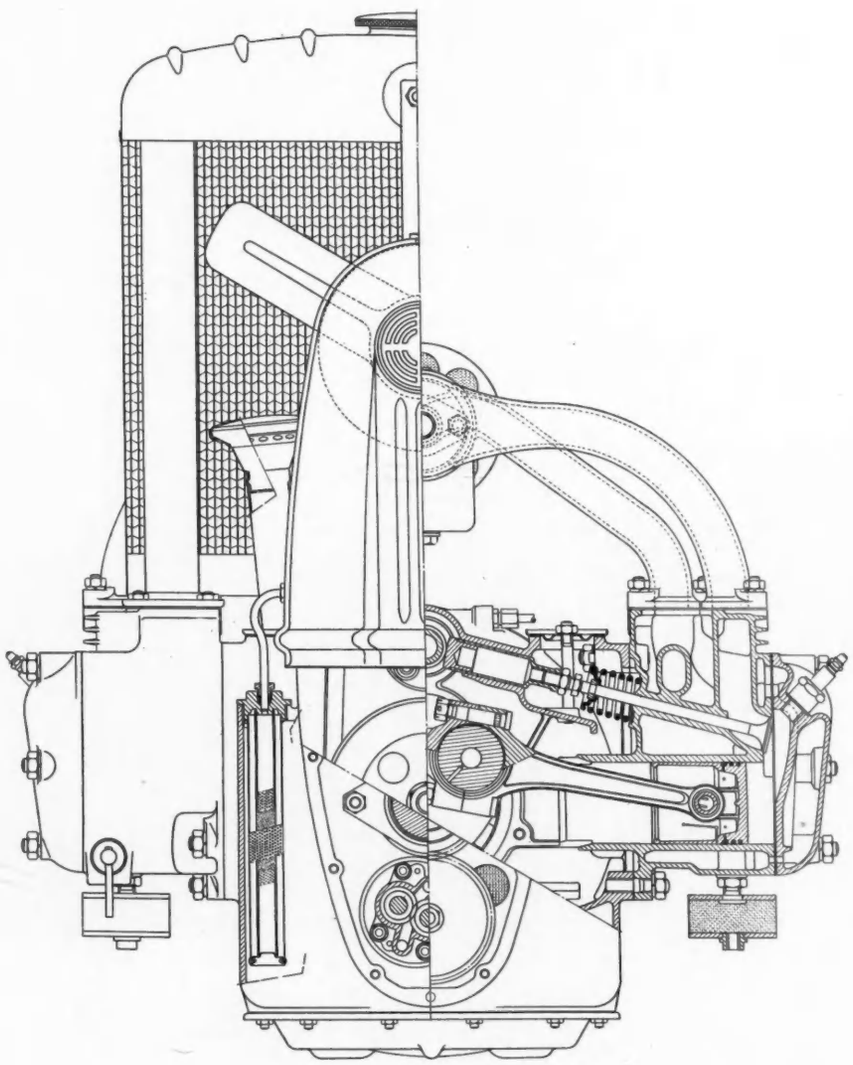


Longitudinal vertical section through crankshaft axis. The four-cylinder horizontal opposed engine has a bore of 59 and a stroke of 90 mm. (2.32 by 3.54 in.) and a displacement of 59.7 cu. in. Its output is 22 hp. Features of the powerplant include detachable cylinder heads, light-alloy pistons, battery ignition, starter-generator, pressure lubrication by gear pump.

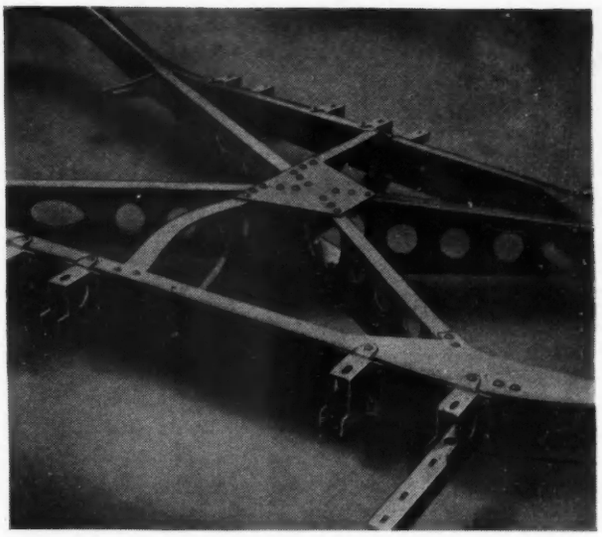
These drawings begin Series 2 of the Engineering Drawings which have been appearing in AUTOMOTIVE INDUSTRIES.

Steyr 50 Powerplant . . .

Front elevation of Steyr 50 powerplant, partly in section. The dry weight of the car into which this powerplant is built is 1630 lb. and the maximum load permissible is 770 lb. The gasoline mileage is 30 to 33 miles per U. S. gallon. The Steyr engine is manufactured by Steyr-Daimler-Puch, A.G., of Vienna.



Two Graham Lines Fitted to '38 Modes

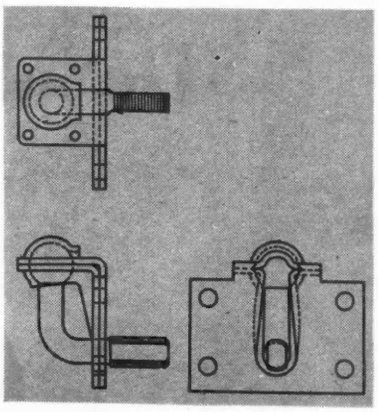


Graham's new cross-bracing through the X-member makes a much stiffer frame. Note that all body brackets are located where a cross member meets the side channels.

GRAHAM lines have been reduced to two for 1938—the Graham Special and the Supercharger, both mounted on a 120-in. wheelbase chassis and equipped with bodies of the same styling. Both models have the same engine, the one with, the other without the supercharger equipment.

An interesting mechanical development is the Evans vacuum-operated gear shift, which is offered as an option. A gear-shift lever curves back from under the instrument board to within easy reach of the operator. This lever is of such length that it permits of hand shifting in the event there is no vacuum or when the vacuum is too low for the purpose.

The Spicer hypoid rear axle has been adopted as standard equipment. An over-drive unit is optional. The transmission is the Warner "roll-over" type, with shifter rails at the side of the housing.



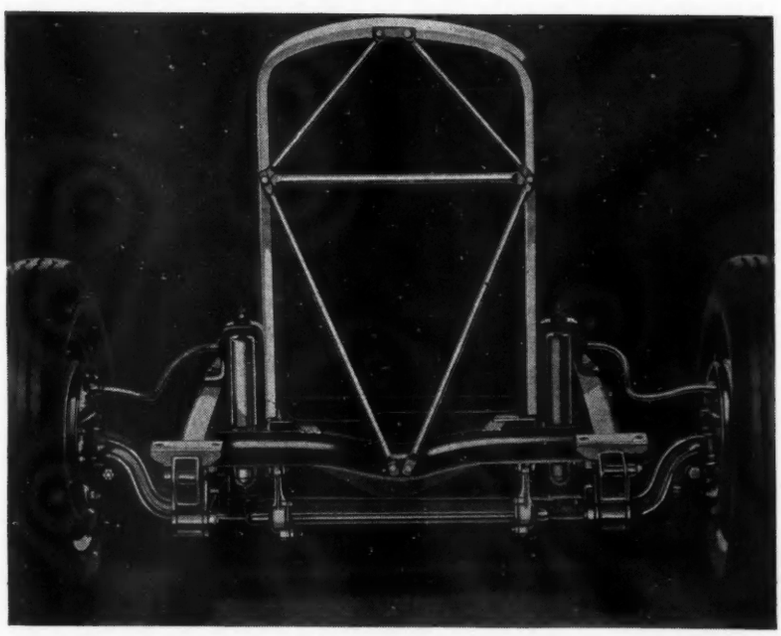
Details of the concealed ball-and-socket hinge on 1938 models.

The six-cylinder L-head engine has a 3¼-in. bore and a 4⅜-in. stroke, which gives it a displacement of 218 cu. in. It is provided with an aluminum cylinder head and the compression ratio is 6.7. With supercharger the engine is rated 116 hp. at 4000 r.p.m., while without this equipment, as installed on the Special, it is rated 90 hp. at 3600 r.p.m.

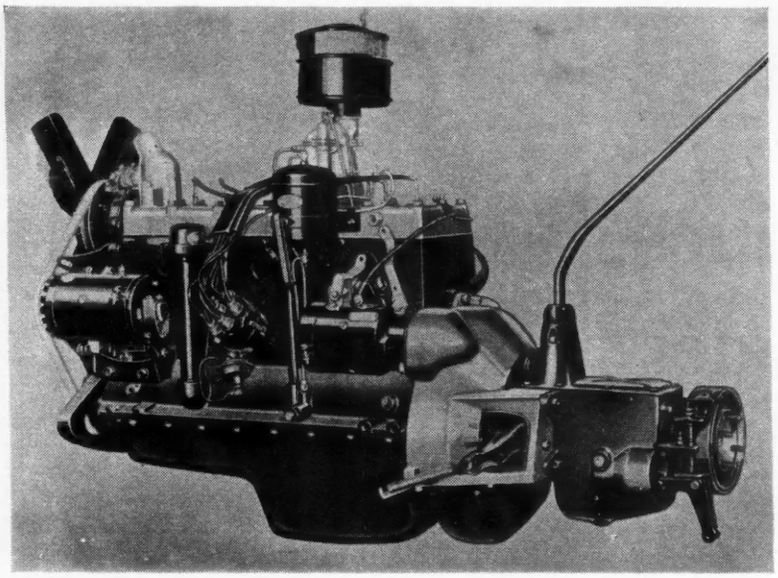
A number of detail changes have been made in the engine. The cylinder head is now fastened to the block by 33 instead of by 20 studs, and the diameter of the studs has been reduced from 7/16 to ⅜ in. This change was made with the object of minimizing cylinder-bore distortion under the tension of the retaining bolts. The diameter of the main bearings was increased from 2¼ to 2⅜ in., and the bearing caps now fit with dowels in reamed holes, for more precise alinement. The front main bearing remains unchanged in size, but has a special shouldered shell. Bohnalite Autothermic tin-plated pistons are continued.

Molded rubber hose is used between the radiator and the water-outlet, to eliminate elbow fittings. The thermostat is fitted in the hose. On the supercharged engine the exhaust manifold now is made in two separate sections, one for the three forward and the other for the three rear cylinders, with separate exhaust pipes to the muffler. This change was made to prevent ex-

(Turn to page 615, please)



Front end truss construction in the 1938 Graham prevents the radiator core and front end of the hood from weaving. This view also shows the telescoping airplane type hydraulic shock absorbers and the gyrolator stabilizer.



A change in the camshaft, causing the intake valves to open sooner has given faster acceleration. It is an L-head, six cylinder engine with a compression ratio of 6.5 to 1 developing 93 hp. at 3600 r.p.m.

DeSoto Improved in C

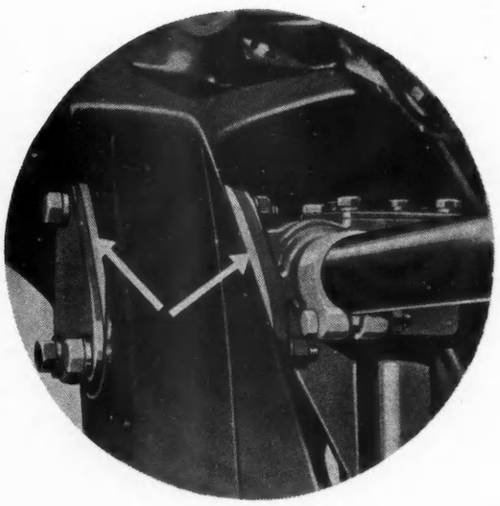
A NEW wider and deeper frame, bigger hydraulic brakes, ride improvements and a new rubber-insulated steering mechanism are the principal mechanical improvements in the DeSoto for 1938. The wheelbase is now 119 in., or 3 in. more than last year, and the overall length over the bumpers has been increased to 199 in.

The new DeSoto is available in seven body styles, including a four-door touring sedan with trunk, a four-door sedan with luggage compartment, a two-door touring brougham with trunk, a coupe with rear luggage deck, a convertible coupe with rumble seat, a convertible sedan, and a seven-passenger sedan. It is available in any one of eight colors—black, Winchester gunmetal, Chinchilla gray, Chinese gold, Gem green, Surf blue, Everglades red or Cinnabar.

Considerable change has been made in the frontal appearance. The radiator grille is made up of horizontal, die-cast, chromium-plated bars which sweep back along the hood to form the side louvers. A band of widely-spaced chromium-plated louvers set off by an outline of body coloring, divides the grille in the center.

The hood is hinged at the center and opens from the side. It has a lock with a plunger bar that lifts the panel high enough to enable one to grasp it easily. Its side panels are bolted in place and act as supports for the radiator, thus taking the place of radiator tie-rods, which formerly interfered with access to the engine.

The sloping windshield is more than an inch deeper, making it easier for the driver to see overhead traffic lights and the like. Windshield wipers are mounted at the base of the windshield. Trunk and luggage-compartment space has been increased by mounting the spare wheel vertically at the rear.



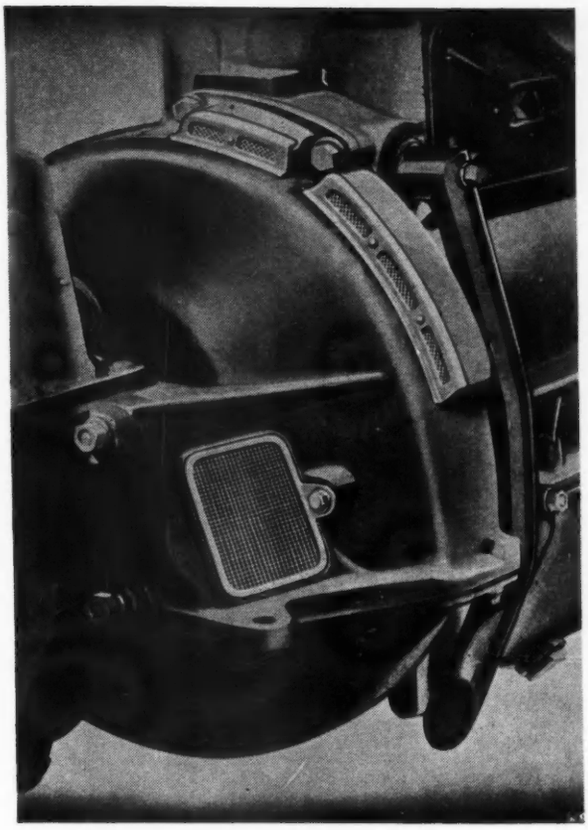
Rubber has been adopted this year for mounting the steering gear housing on the frame

The "safety-interior" features introduced last year have been retained, including the smooth instrument panel without projecting knobs or controls, panel above knee height, door handles curved inward and flattened. Instruments are fully visible through the three-spoke, open-top steering wheel. The rays of the cowl lamp pass through the numerals from the back, thus making them stand out at night. Defroster vents, at both ends of the instrument panel, are larger. Heaters are available at extra cost and are larger than those formerly supplied by Dodge.

A "pistol-grip" type of brake lever, located just under the dash to the right of the driver, has taken the place of the former floor-mounted lever. Adjustment of the front seat is by means of a side latch and equalizing bar. The side-latch control enables the operator to adjust the seat forward or back without stooping over, while the equalizing bar assures parallel movement of the seat in either direction. The seat is mounted on a ramp and rises approximately 1 in. when moved from the rear to the forward position, a spring helping to raise it. The higher forward position assures maximum visibility for shorter drivers.

Front seats measure 47 in. in width, rear seats, 48½ in., and there is adequate room for six people in the car. Both seats are of "chair height." Drip moldings extend the full length of the car over all doors and windows.

Frame side rails have been increased in depth from 5½ to 6 in. Side members are joined by an X member as well as by straight cross members. A new feature this year are two sub side rails at the dash line which add rigidity to the frame where the bending moment on it is greatest. The cross member



The air-cooled clutch operates with a ballbearing release. A clutch baffle plate has been added to prevent vapors from reaching the clutch driven surfaces

which supports the rear end of the engine is stronger and more rigid. At the center the X member is 9½ in. deep and has gusset plates riveted to it at top and bottom.

The new frame is approximately 5 in. wider at the dash line and 7 in. wider where the steering gear is attached. This greater width is said to cut down sway and to increase the stability on curves. With this new, wider frame, some of the fourteen styles of body are mounted directly on the side rails, which gives greater front-seat rigidity.

n Chassis and Body

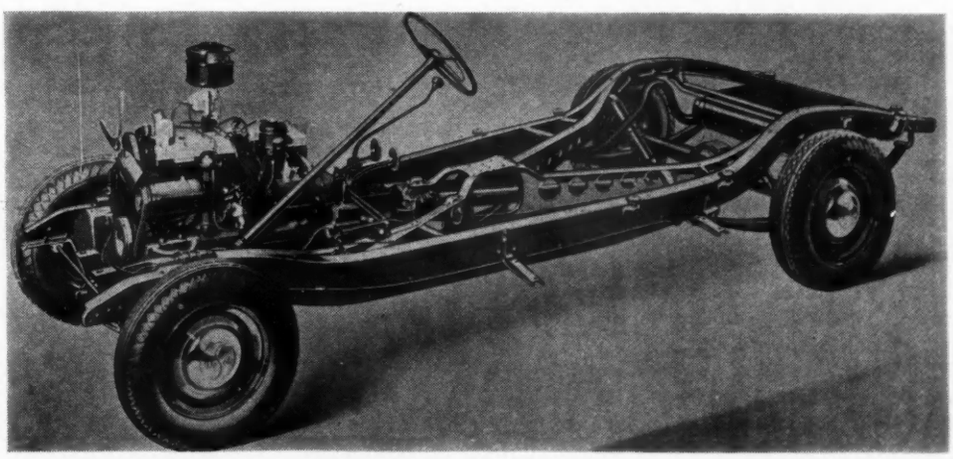
Rubber mountings prevent metal-to-metal contact between frame and body.

Drums of the hydraulic brakes have been increased in diameter from 10 to 11 in. Brake shoes are heavier and stiffer, and the brake drums have a higher ribbed flange that not only makes them stiffer but also assures better heat radiation. A finer finish of the brake drums is said to reduce wear and prevent brake knock. It is claimed that as a result of these improvements, brake fade has been practically eliminated. The necessary pedal pressure has been cut down materially. Stepped brake cylinders, larger at the rear, equalize shoe pressures and lining wear.

A number of improvements have been made in the suspension. The upper control arms of the front independent suspension are more rigid. The rubber cushioning inside the coil spring is softer. All movable joints in the suspension are now sealed. Hardened-steel threaded bushings have been placed in the upper control arms. Changes have been made also in the direct-type, double-acting hydraulic shock absorbers. In the front the upper part of the shock absorber is attached directly to the upper control arm, the lower member to the lower control arm.

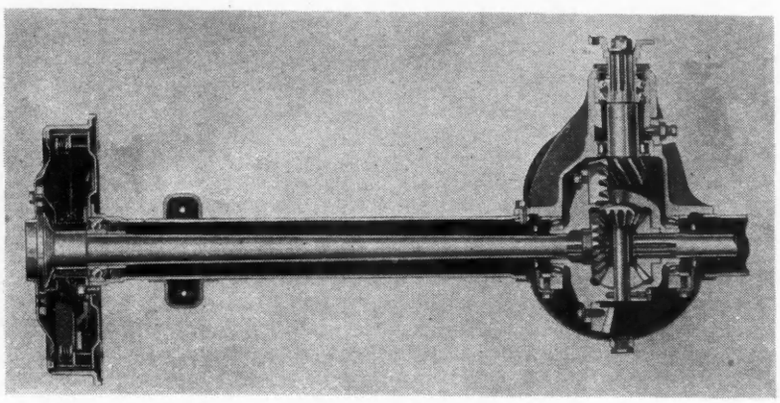
Only minor changes have been made in the engine of the DeSoto, which is a six-cylinder L-head of 3⅜-in. bore and 4¼-in. stroke, with a total piston displacement of 228.1 cu. in. It has symmetrical connecting rods, aluminum-alloy, anodized pistons with U-shaped slots and four piston rings each, hardened steel exhaust-valve inserts, full-length water jackets, a water-distributing pipe, by-pass thermostat, automatic spark advance and "floating-power" mounting. An aluminum cylinder head with a compression ratio of 7 is available. A change in the camshaft, causing the intake valves to open 8 degs. earlier, has improved the performance of the engine. A new application of rubber in the DeSoto this year is in the

(Turn to page 599, please)



Chassis has a stronger, deeper and more rigid frame. The side rails have been increased to six inches in depth

Pontiac Enters 1938 Season with S



Pontiac rear-axle assembly. The gear ratio on both the Six and the Eight is 4.375 to 1. The propeller shaft and rear axle used on the new models are the same as the 1937 design

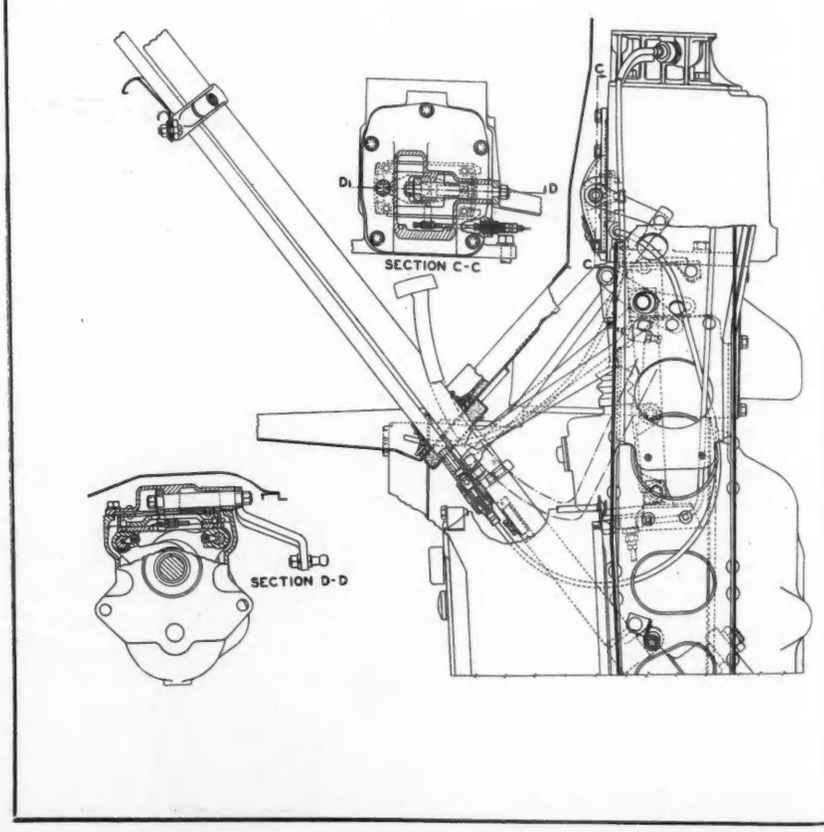
ENTERING the 1938 season with further refinement of its silver-streak styling, Pontiac announces changes and improvements in hardware, body interiors, and major units. Basically, the body and chassis continue unchanged.

Hood sides normally are fixed but may be readily removed for service operations. Wheelbases remain the same —117 in. on the Six, 122 in. on the Eight.

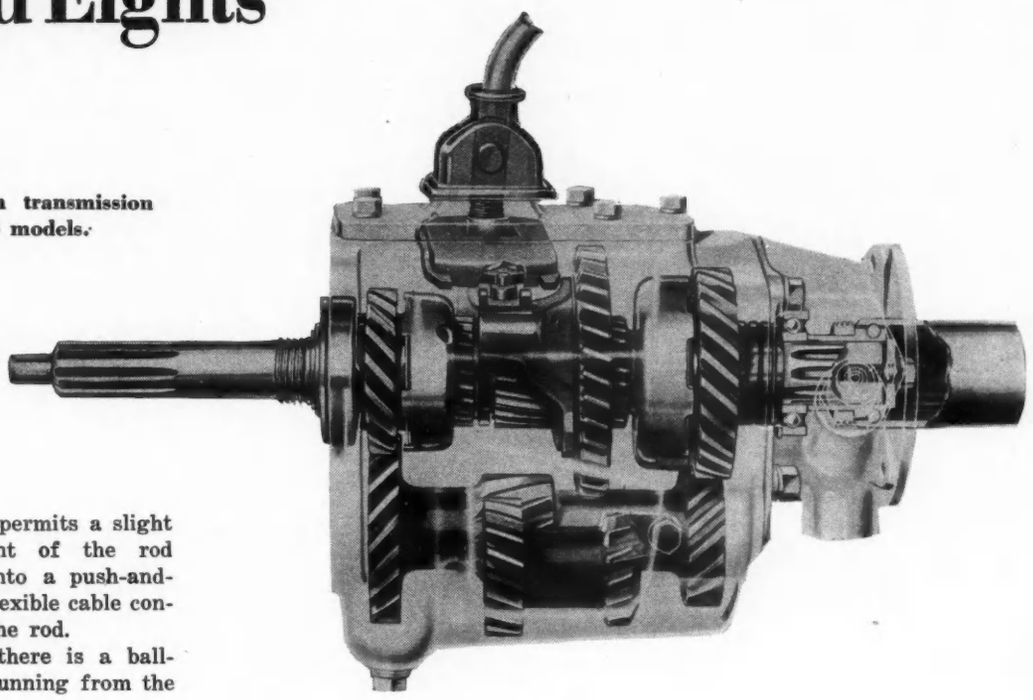
Safety features are strongly emphasized, and comprise the following items: Safety instrument board with rolled edge and recessed control knobs; safety roll on front sea backs; safety robe cord, and flat window control knobs.

Lamps are relocated and appear on the front fenders on streamlined supporting brackets. Bumper guards are now standard equipment.

The most interesting of the mechanical features is the Safety-shift gear shift which is optional equipment at a small extra charge. It is essentially a remote control for the transmission, by means of a lever mounted on the steering column under the wheel. While the operation of the new remote control requires no new driver habits, its operating mechanism is of interest. The chief difference between this control and the conventional wobble stick is that the cross-over motion is up and down instead of crossways. The control lever is mounted in a small pressed steel housing and communicates with a tube extending down outside the steering column. As illustrated, the lever terminates in a spring-



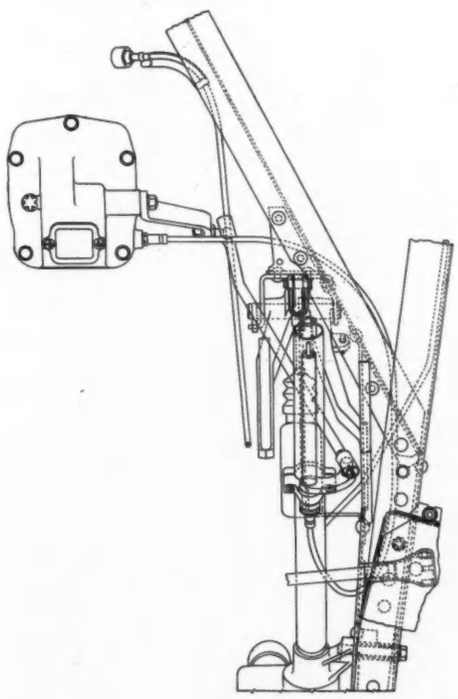
Sixes and Eights

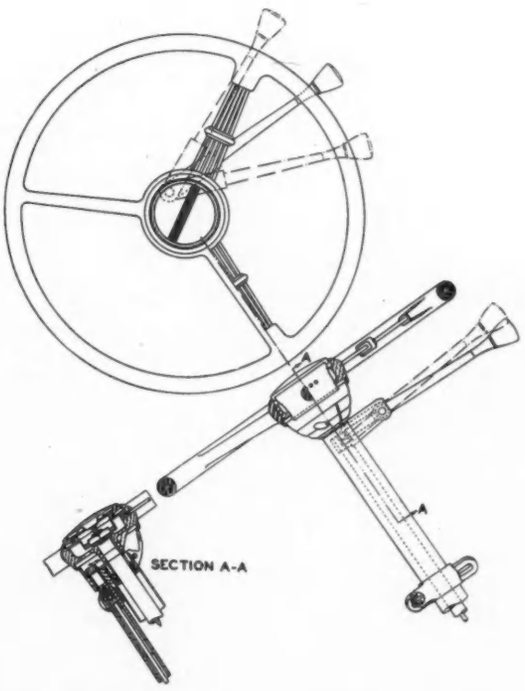


Improved synchro-mesh transmission used on the 1938 models.

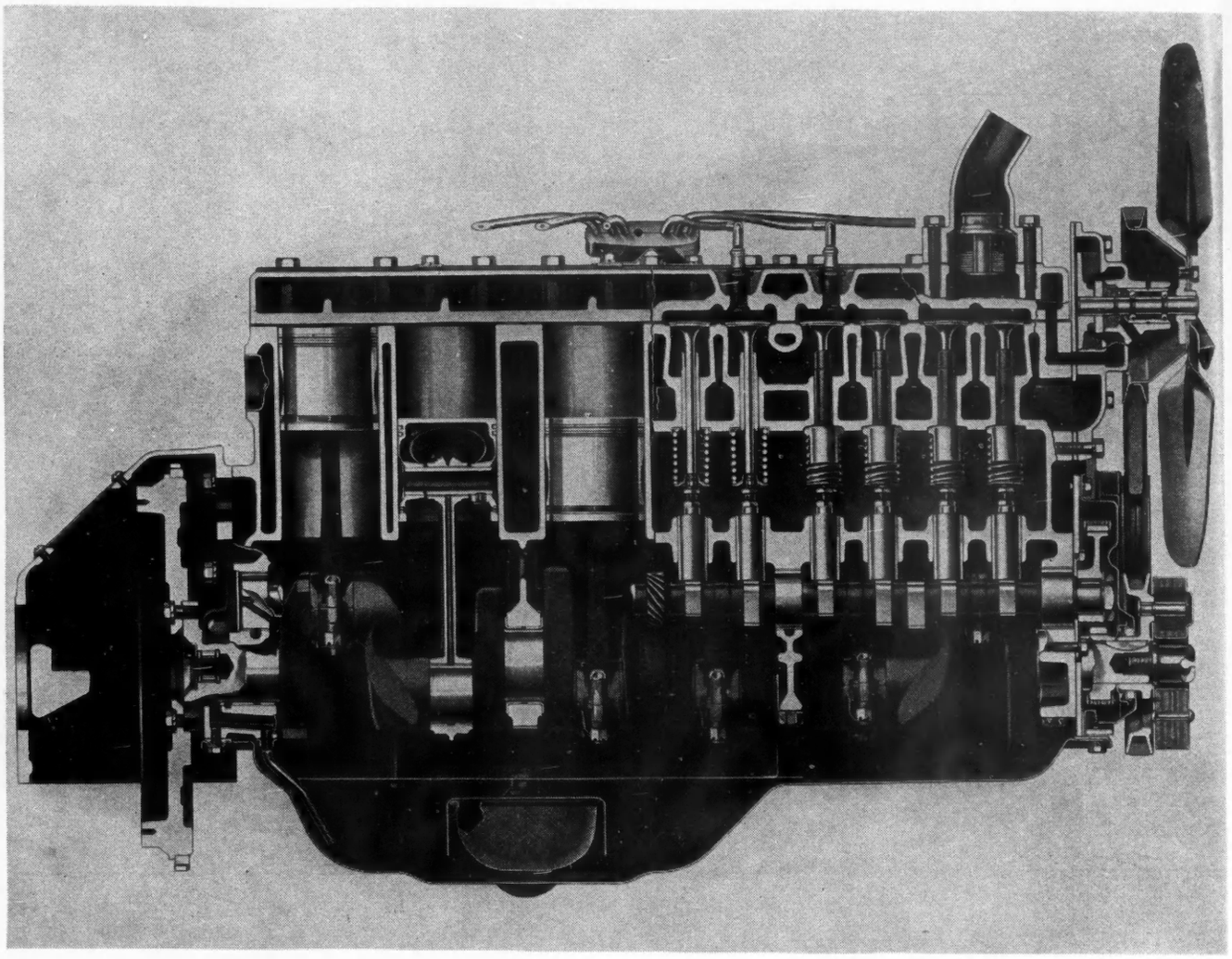
loaded ball end which permits a slight up-and-down movement of the rod which is translated into a push-and-pull action through a flexible cable connected to the end of the rod.

For gear shifting, there is a ball-and-socket drag link running from the





(Bottom of facing page and above) Assembly views of Pontiac Safety-shift gear shift offered as optional equipment.



Longitudinal section of the Pontiac 6-cylinder L-head engine. It is rated 85 hp. at 3600 r.p.m. with cast iron head and a compression ratio of 6.2.

lower end of the control rod over to a lever mounted on the gear box cover. Thus there is a flexible cable for cross-over and a direct mechanical link for shifting.

Engines remain basically unchanged. The Six is an L-head of 3 7/16-in. bore by 4-in. stroke (223 cu. in. displacement) rated 85 hp. at 3600 r.p.m. with cast-iron head and a compression ratio of 6.2. The Eight is an L-head of 3¼-in. bore by 3¾-in. stroke, 249 cu. in. displacement, rated 100 hp. at 3800 r.p.m., with cast-iron head and compression ratio of 6.2.

The ball-bearing water pump which was placed in production during the 1937 production season is continued with a minor change—locking the composition thrust washer by means of two ears. Pontiac continues the alloy-iron pistons with a slight change on the Six, consisting in the addition of a rib to support the head. The design of the Eight with its smaller diameter piston remains the same.

An auxiliary economizer-nozzle control has been added to the carburetor to eliminate the flat spot on quick acceleration. This acts on the manifold depression, while the conventional control remains connected to the throttle linkage.

The fan, which has blades in pairs at 76 degrees, has greater capacity and is more quiet in operation. Generator capacity has been increased 30 per cent. Batteries are of the new Delco end-to-end cell type and are mounted under the hood. For the Six, the battery is 15-plate, rated 98 amp.-hr. capacity; for the Eight, 17-plate, rated 112 amp.-hr.

To assist in making gear shifts, as well as to reduce the clutch-pedal pressure required, the clutch pedal now is fitted with an above-center helper spring. The transmission has been altered in some details. Smoother second speed shifts can be made with new two-lobed synchronizer drums of slightly smaller diameter, retained with hexagonal springs instead of detent and cushion springs. Countershaft gear bearings are held in place by a perforated spacer which improves the flow of lubricant.

Knee-action has been improved by the introduction of hardened-steel, replaceable threaded bushings and rubber seals for the lower control-arm shafts. The pitman arm has been raised ¾ in. on the Six and ⅝ in. on the Eight, to provide more road clearance.

Defrosters now are located in the windshield garnish molding, with longer slots to handle a doubled capacity of the blower.

The propeller shaft and rear axle remain unchanged, the gear ratio being 4.375 on both the Six and the Eight.

Refinements Stressed In 1938 Plymouth

PLYMOUTH, which is observing its tenth anniversary this year, is offering its 1938 line in three "business" and eight "deluxe" body styles on a chassis of 112-in. wheelbase with an 82-hp. engine. While the car is substantially identical with last year's model, its appearance has been changed materially by giving it a new front-end treatment. The hood is longer and sweeps forward farther at the top, to meet the radiator grille, which is now more nearly vertical. Headlamps, of tear-drop form, are larger, and front fenders, which drop 1½ in. lower in front, merge into a new rounded front apron in body color.

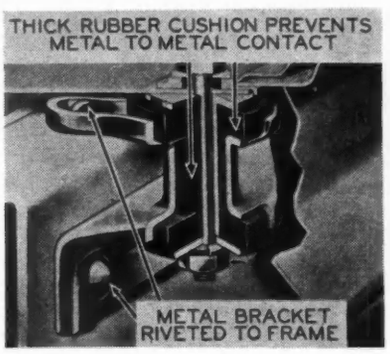
The grille consists of vertical chromium-plated bars on both sides of a solid center strip in body color which extends straight up to the top. At the base the grille becomes rounded at a higher level than before, to tie in with the new apron, which latter carries a modernized wing motif in the center and two sets of vertical chromium stripes at the edges. The Plymouth radiator ornament, a sailing ship in profile, becomes a full four-master and is enclosed in a tear-drop outline.

Hood louvers continue the lines of the headlamp supports. Side panels of the hood are now fixed in position, and only the top portion swings open for routine service (water and oil). The hood handle remains on the side panel. By means of this handle the top section can be locked in place or, alternately, opened slightly, to be lifted the rest of the way by the fingers. The side panels, which can be readily removed for special service, form a brace between the body and the radiator shell, which latter is also more rigidly mounted this year by reason of the new steel apron across the front.

Door handles remain of the safety type. Windshields are carried up higher, for better upward vision. Color accents on the outside of the car constitute a new note in styling. Coach vermilion is the accent color, and is used in the wing motif on the front apron, and in the front and rear medallions. The rear medallion features the new four-masted sailing ship in profile within an oval frame.

Interiors are finished in sable brown, with coach vermilion accents at the center spots of two instrument dials, and on the horn button. Broadcloth and mohair are optional as upholstery materials. The instrument board and garnish moldings are the solid sable brown. Upholstery has wide parallel pleats.

This year's instrument panel, with all controls sunk or recessed flush with the surface, has everything centered. There are two large dials, one to show speed and mileage, the other containing fuel and oil gages, ammeter and heat indicator. Both dials are now face-lighted, instead of through the edge. The two dials are spaced farther apart than before, but are tied together by horizontal metal bars which enclose a center panel with a drawer-type ash tray in the lower half, and the top half specially designed to accomodate radio controls. The horizontal bar motif continues in a narrow band beyond both sides of the center panel, across the entire face of the board.



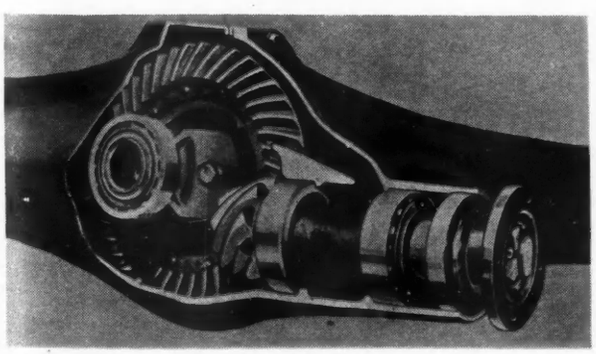
Close-up view of Plymouth's new body mounting which shows how the body is pillowed on cushions of live rubber.

The glove box, with an improved latch, now occupies the whole right side of the panel. All controls for headlights, throttle, choke and instrument lights still occupy a recess below the center of the board. The complete control group ranges on both sides of a recessed key slot that is lighted for convenience. The entire panel is rounded off at the bottom edge, and set up safely above knee-height of the average passenger.

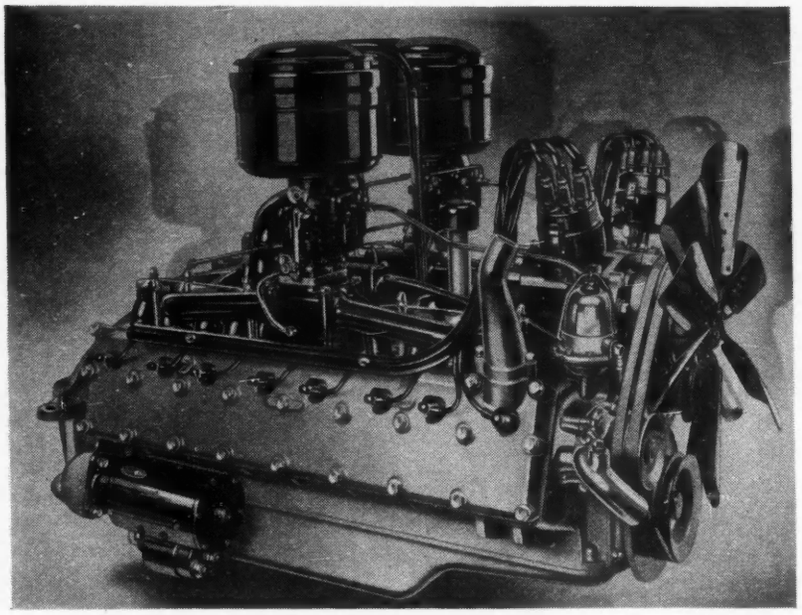
Several conveniences have been added. Wide drip moldings extend the full length of the car over all doors and windows. New defrosting or anti-fog vents are built into the base of the windshield, in front of both driver and passenger. With this year's improvements in heaters and connecting hose, the defrosters throw 60 per cent more warm air up to the windshield.

The adjusting mechanism causes the front seat to rise while it is being moved forward, a spring assisting the forward motion and an anti-cocking

(*Turn to page 611, please*)



Hypoid rear axle is standard equipment on all 1938 Plymouth models.



The new Cadillac V-16 engine with two banks of cylinders at 135 deg.

DURING 1938 Cadillac cars will be produced in two eight-cylinder and one sixteen-cylinder lines. The Twelve has been dropped. The LaSalle is continued practically unchanged mechanically. In an effort to simplify the manufacturing program, wheelbases have been reduced to four, engines to three, and chassis to five, but the number of body styles has been increased from thirty-four to thirty-five. One of the most notable improvements in the line is the mounting of the gear-shift lever on the steering post below the wheel, which leaves the front compartment unobstructed.

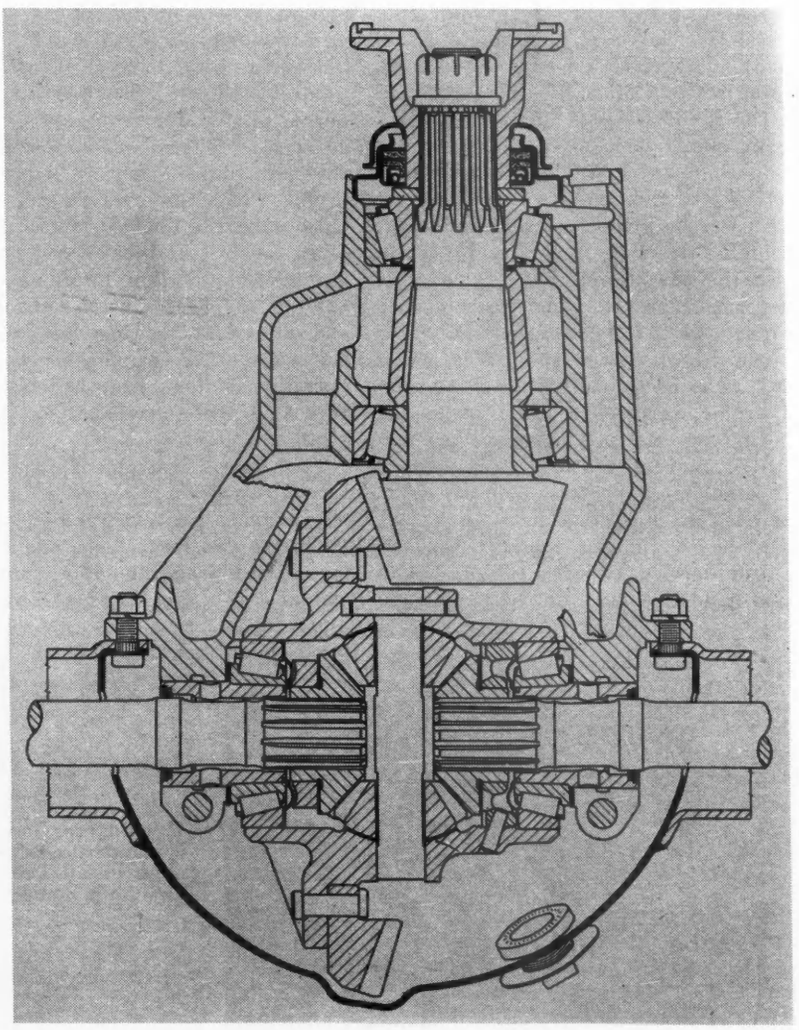
Hypoid axles are standard on all models. All Cadillacs have longer wheelbases, and all have a transverse muffler behind the fuel tank. Safety features include instrument-panel knobs set in recesses, safety hardware, and (on Models 50 and 60) a soft roll on the back of the front seat. On all models except the V-Sixteen the batteries are mounted under the fender, and all have fixed but removable "alligator" hoods.

Engines

The eight-cylinder engines remain basically unchanged. That of the LaSalle, with 3⅜ in. bore and 4½ in. stroke (322 cu. in.), is rated 125 hp. at 3400 r.p.m., with a compression ratio of 6.25.

The Cadillac V-8 engine, of 3½ in. bore and 4½ in. stroke (346 cu. in.), is rated 135 hp. at 3400 r.p.m., with a compression ratio of 6.25. Alternate compression ratios of 5.75 are optional on all V-8 engines. Because of the longer wheelbase and the larger bodies of the "75" line, engines for this chassis will be built with a higher compression ratio and have a higher rating. This job will have a standard compression ratio of 6.7, but ratios of 6.25 and 5.75 are optional. With the higher standard compression ratio the rating is 140 hp. at 3400 r.p.h. Ethyl gasoline is specified for use with this engine.

Improvements in the Cadillac V-8 are headed by the provision of a torsional vibration damper and a novel "Syncro-flex" flywheel designed to assure smooth operation throughout the speed range. The chief function of the "Syncro-flex" flywheel is to eliminate the effects of bending of the crankshaft (transverse vibration). In the



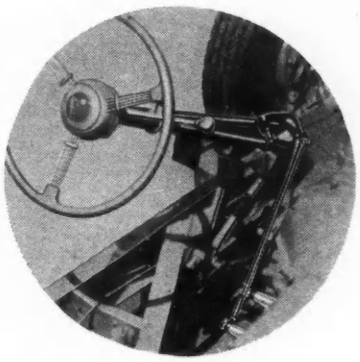
Sectional view of the hypoid gear drive

1938 Cadillac Line Features New V-16

new flywheel the cast iron rim is connected to the hub by a steel disc which, while rigid torsionally, is flexible laterally. On both sides of the supporting disc are damping plates which press against the flexible flywheel web. When an engine runs at speeds at which synchronous crankshaft bending occurs, the usual rigid flywheel will move with the crankshaft, which causes it to run with a wobbling motion producing engine noise. With the new design, the flexibility of the web permits the rim to run in a true circle, regardless of crankshaft deflections. Rubbing of the damping plates against the flywheel web absorbs energy and damps out the vibratory motion of the crankshaft.

An oil seal of asbestos composition replaces the former slinger-type seal on the rear main bearing. The oil filter for the protection of the hydraulic valve-silencer mechanism has been found unnecessary and has been eliminated. On the V-8s the oilpan drain has been moved to the left side to make it more accessible.

In the Carter carburetor, which is standard on the LaSalle, the metering jet is now air-cooled, to improve "hot-starting," and an improvement in the metering characteristics gives more satisfactory part-throttle operation. On the Stromberg carburetor a vacuum-operated economizer has replaced the former throttle-operated economizer. This makes it possible to run on a leaner mixture at light loads, since the mixture is enriched whenever more power is required, even with a small throttle opening.



Cutaway view of Cadillac-LaSalle gear control

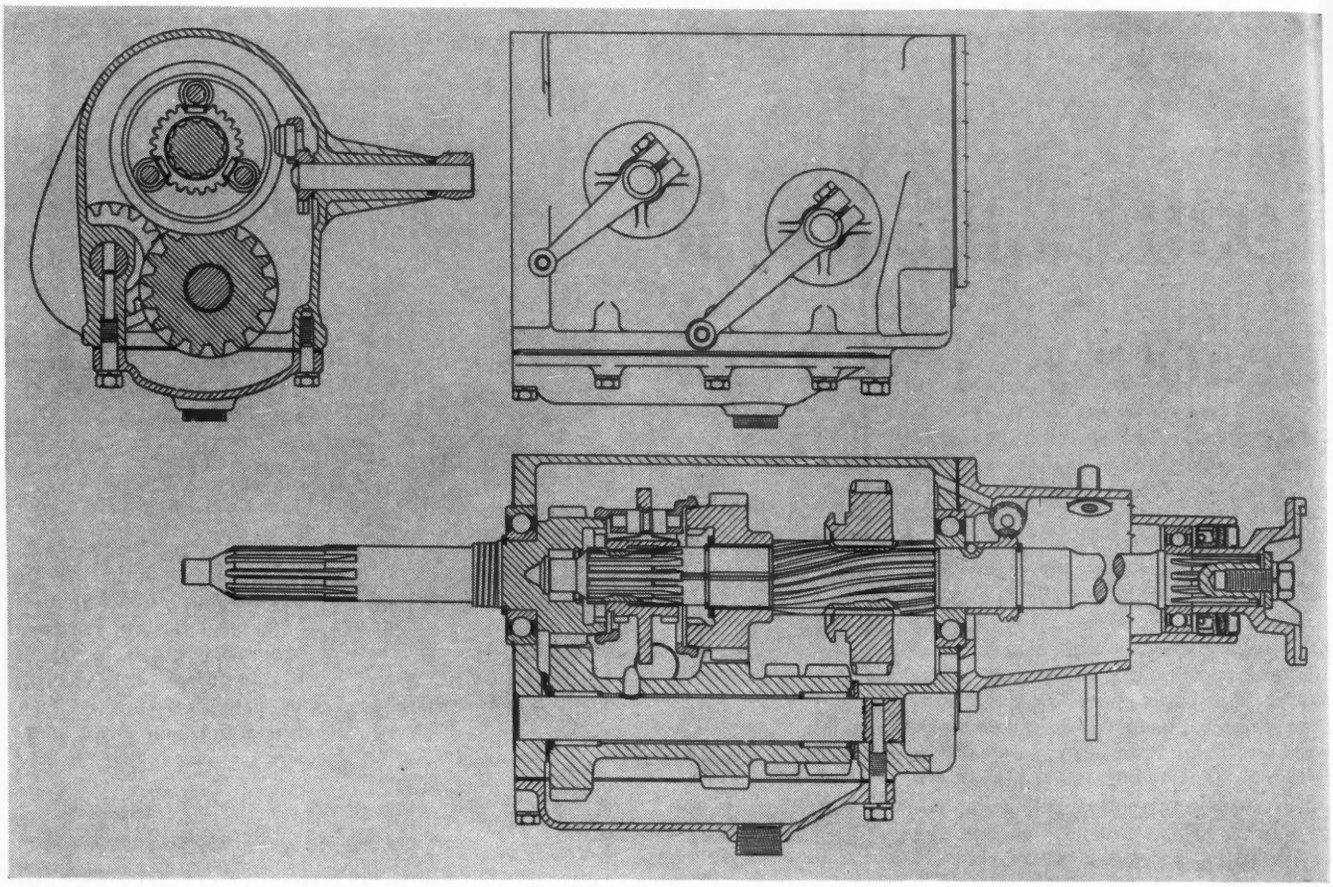
All models use the Long single-plate, semi-centrifugal clutch. On Cadillac V-8s and on the LaSalle the clutch now has eight damping springs instead of ten, which decreases its spinning weight. Clutch diameters remain 11 in. for the Cadillac V-8 and 10½ in. for the LaSalle.

The new V-Sixteen engine has two banks of cylinders at 135 deg. It is therefore, almost "flat," and the cylinders are of "square" design, the bore and stroke being 3¼ in. each, which makes the displacement 431 cu. in. This engine is rated 185 hp. at 3600 r.p.m., with a compression ratio of 7. Engine mounting is on rubber at five points.

Like the V-8s, the V-Sixteen is fitted with the hydraulic valve silencers. The block is a one-piece casting. Nine main bearings and five camshaft bearings are provided. A rubber-type torsional vibration damper is used but the flywheel is of conventional design. Short, light connecting rods are used, with crankpins of only 2-in. diameter, permitting withdrawal of rods and pistons through the head. The piston pin is locked in the rod.

To assure reliability and simplicity of service operations, the V-Sixteen engine is fitted with dual accessories wherever possible, making it in effect two eight-cylinder engines. A new departure for Cadillac is the use of two

Cadillac chassis. Note muffler mounted transversely at extreme rear



Sectional assembly drawings of transmission now used on all Cadillac and LaSalle models

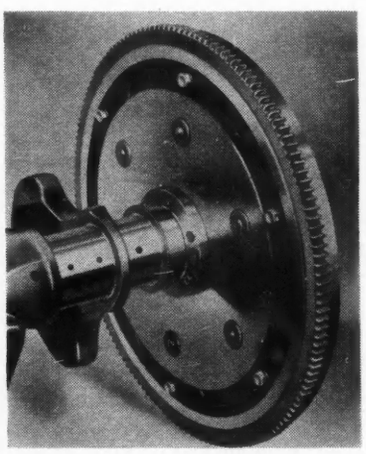
separate water pumps. There are also two duel intake manifolds, two exhaust manifolds, and two oil-bath air cleaners.

An unusual feature is the generator drive, which is off the fan belt but through the intermediary of a friction drive. In this construction, the fan is driven by dual belts which also drive a shaft supported by a double-row ball bearing, to which is secured a drum containing a rubber driving ring contacting a friction wheel on the generator. The entire mechanism is supported by a bracket, which may be raised or lowered to adjust the belt tension.

The clutch is a Long 11½-in., semi-centrifugal, without dampers.

Chassis Features

All Cadillac chassis have lower and torsionally stiffer frames, the lowering having been made possible by the adoption of hypoid axles for the entire line. Owing to the lowering of the frames, the mufflers are now mounted transversely at the extreme rear. Spring liners are used on all models. Minor changes in the transmission used on last year's LaSalle and Cadillac have so increased its capacity as to make possible its use on all models, including the V-Sixteen.



A source of vibration has been eliminated from the Cadillac V-8 engine by the introduction of a flexible disc into the flywheel

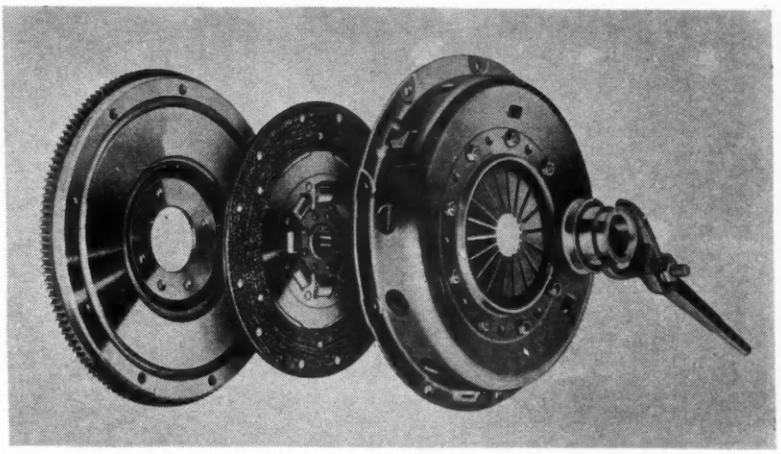
From the standpoint of the driving public, perhaps the most interesting change is the mounting of the shift lever on the steering post, for which arrangement the term "Syncromatic Control" has been coined.

The short transmission lever projects to the right from a housing just below the steering wheel hub, its ball end being convenient to the driver's right hand. Within the housing the lever is pivoted on the left side of the steering column. From the control-lever pivot two concentric shafts extend nearly parallel with the steering column. Below the floor boards each of these carries a lever, and links connect these levers to two others on short shafts extending through the transmission case. Inside the case these shafts carry the shifter yokes which engage with the shifter spools for the low and reverse and the high and intermediary gears respectively. In addition to clearing the front compartment of obstructions, the arrangement has the advantage that it reduces the transmission of the gear and other noises into the body.

From the driver's standpoint, the operation remains virtually unchanged. The lever is lifted and moved to the rear to engage low, or lifted and moved toward the front for reverse; similarly, depressing and moving forward or backward engages second or high. Lifting the lever engages one of the two concentric shafts which is connected to the low and reverse shifter spool, while depressing the lever selects the other shaft, which operates the high and intermediate position clutch.

(Turn to page 612, please)

New Clutch for Chevrolet '38 Trucks



Heavy-duty diaphragm-type clutch used on the ¾-ton, 1-ton, and 1½-ton 1938 Chevrolet trucks. It has been made larger to provide greater torque capacity and durability.

IMPROVEMENTS in the Chevrolet truck lines for 1938, so far as the chassis is concerned, parallel those of the passenger-car chassis, outstanding among them being the adoption of the new diaphragm-spring clutch.

In the light-delivery series, two commercial-vehicles are available on the passenger-car chassis of 112¼-in. wheelbase, viz., the coupe pick-up and the sedan delivery models. Half-ton models, all on a truck chassis of 112-in. wheelbase, include the pick-up, panel-canopy express, and carry-all suburban.

The three-quarter ton and the one-ton series each includes pick-up, stake, and panel models, and both are built on chassis having a wheelbase of 122¼ in. The ton-and-one-half series, classed as heavy-duty, includes the pick-up, stake, canopy-express and panel models, on a chassis of 131½ in. wheelbase, and high-rack, stake-express and stake models on chassis with a wheelbase of 157 in. In addition to its regular truck models, Chevrolet this year is offering a chassis of 201-in. wheelbase for school-bus operation.

In the new commercial vehicles, not only the radiator grille but also the radiator core is readily removable. After the shell cross brace has been unbolted and the radiator-mounting bolts have been removed, the core can be moved back slightly so its mounting flanges can pass through clearance slots in the flange at the top of the shell, to which the radiator upper baffle is bolted. In order to provide more room for a wider, stronger shell cross brace, the radiator filler neck has been moved to the front of the radiator upper tank. The hood catch handle has been reshaped to fit closer to the hood side panel.

All front bumpers are now regular production equipment. Rear bumpers also are regular production equipment on all half-ton, three-quarter-ton, and one-ton body types, with the exception of the platform types.

An opening through the right side of the cab behind the door allows the fuel tank filler neck to project outside. A formed rubber seal around the neck seals the opening. The body half of the door hinge is increased in thickness to ¼ in., for greater rigidity. A new windshield wiper motor, with knurled control knobs, is recessed flush with the inside surface of the windshield header, for greater safety.

Seat cushions and back have been redesigned for greater durability and comfort. The thick pad which covers the springs of the driver's seat is treated with latex, to assure a durable, non-separating cushion padding. Both the seat back and cushions are trimmed with a rubberized material which retains the original smoothness longer. The bottoms of both cushions are sealed, but the cushions are vented to regulate the deflection of the seat springs.

On all panel bodies a heavy impregnated felt pad is cemented to the under side of the top, and is covered by trim material for improved appearance. Sides are insulated with the same material, and are paneled with much stronger composition board.

On all half-ton, three-quarter-ton, and one-ton single-unit-body types the fuel tank is now mounted directly on the frame, with the filler neck extending outside of the body. On the half-ton, three-quarter-ton and one-ton panel and canopy-express bodies, the seat-adjusting mechanism has been redesigned for easier operation, and the seat now slides on channels. The same type of seat is used on the corresponding body types of the one-and-a-half-ton truck, but on these seat adjustment is accomplished by means of a thumb screw.

Solid-section weather strip is used around the rear doors. New door checks are added, and these also retain the doors in the fully-open position until they are pushed out. All hinges are reinforced, and new door bumpers are added at the top to eliminate movement of the doors and to cushion shocks at this point. The cut-out at the rear door striker has been eliminated, and a reinforcement added.

To obtain a better seal on the carry-all suburban doors, a new hinge has been designed so that the same type of weather-stripping may be used as on the panel-body rear doors. The rear upper door now overlaps the end gate, and a new weather strip is employed there to prevent the entrance of water and dust.

On the platform bodies, the corner junction of the rub rails has been redesigned for greater strength. The rub rails now overlap, where the bolts go through, instead of merely abutting.

The engine is continued practically unchanged, but the same type of diaphragm-spring clutch that is featured on the new passenger car is also found on the commercial vehicles. Rear mounting plates (for the engine) have been increased in thickness 1/32 in., to 5/32 in. In addition, the lower edge is radially flanged at each end toward the center, and forms a cup-like retaining

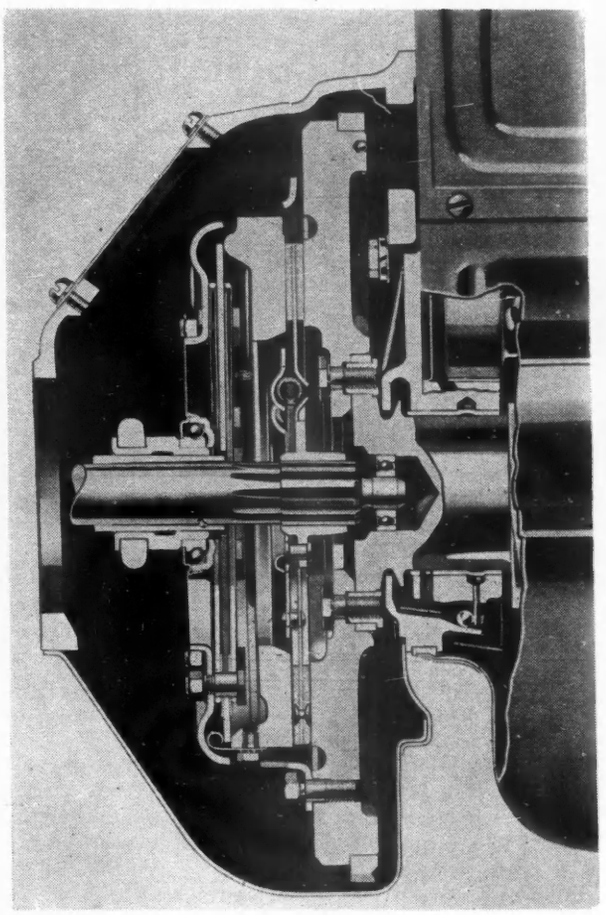
(Turn to page 614, please)

"Tiptoe-matic" Clutch Feature of 19

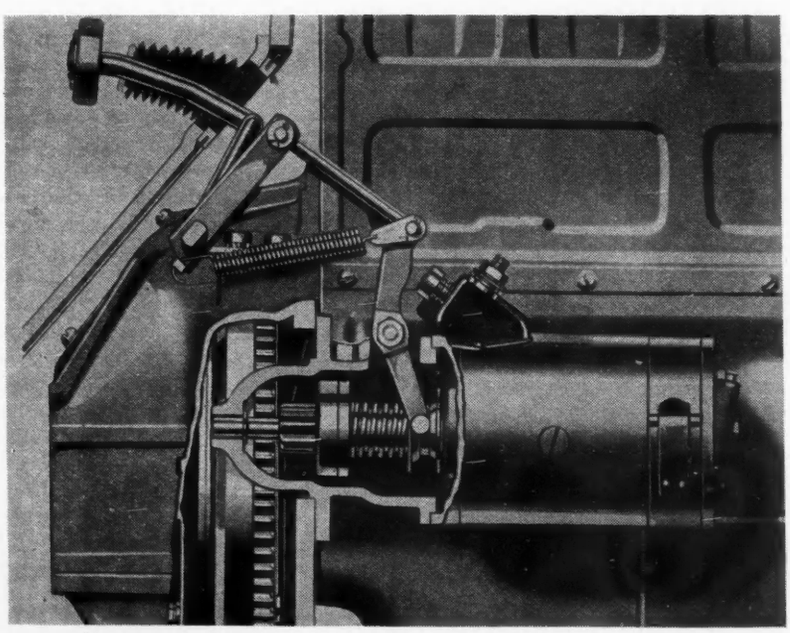
CHEVROLET continues its two lines for 1938 with one important change in the mechanical units—the adoption of a new design of friction clutch having one diaphragm spring instead of the nine coil springs of the old clutch and requiring only 25 lb. average pedal pressure to release it, instead of 33. The new clutch is called the "Tiptoe-matic." In addition to the new clutch the new models show refinements in bodies, both interior and exterior, and in chassis units. The powerplant of both series is the six-cylinder (3½-in. bore, 3¾-in. stroke, 216.5 cu. in. displacement) valve-in-head high-compression engine of 85-hp. rating. All models have hydraulic brakes, turret-top-all-steel bodies by Fisher, and hypoid rear axles. On the Master DeLuxe series front independent suspension (knee-action) is standard for the fifth year.

The most notable change in the outward appearance is at the front end. The top of the hood sweeps forward from the cowl in a graceful curve, to cap the almost vertical flat-topped radiator and grille. The latter consists of chromium-plated horizontal bars, flowing back from the center line of the grille to blend into the radiator shell. To accentuate these lines, every fifth bar is made of double width and pin-striped down the center with vermillion enamel. The new Chevrolet emblem, in cream letters on blue, embossed in a die-cast winged shield, is centered at the top. The "speedline," introduced last year, is continued.

The radiator grille is now made in

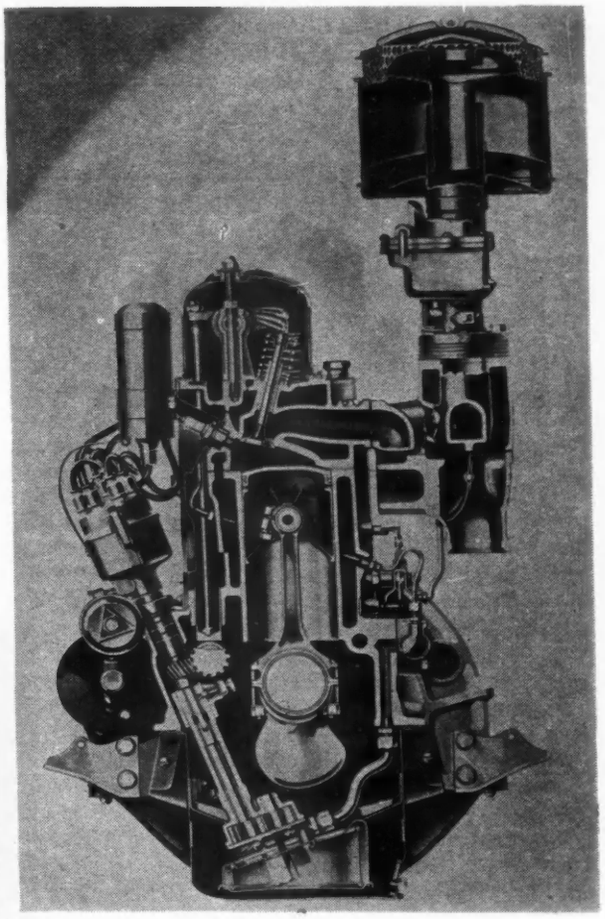


Sectional view showing constructional details of Chevrolet's new "Tiptoe-matic" clutch.

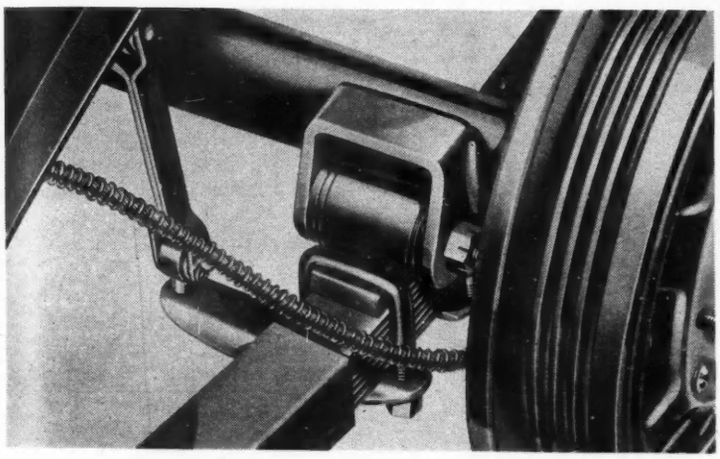


Sectional view of 1938 Chevrolet starting mechanism with over-running clutch disengaged.

1938 Chevrolet



(right) Transverse sectional assembly view of 1938 Chevrolet 6-cylinder, valve-in-head engine.



Close-up view showing new rubber-floated, spring-to-axle housing mounting.

two sections, which has advantages from the standpoints of economy and ease of servicing, as each section can be removed and replaced separately. The radiator core, moreover, can be quickly removed without disturbing any engine parts.

Style changes have been made also in the louvers, the headlamps and their mountings, hood side panels, running boards, and body hardware. Outside door handles are in-curved at their ends, for safety, and carry the vermillion-enameled pin stripe found on the grille.

Changes in engine design are of the nature of refinements. For instance, the new clutch has permitted a reduction in the weight of the flywheel, which assures a quicker response to the throttle. The contact area between the valve stems and their guides has been increased, to provide a greater area of heat transfer. The depression in the engine head is smaller, and there is more metal in the valve head, which blends into the stem in a long taper affording a better bracing. The valve guide no longer projects into the hot exhaust gases, but comes flush with the wall of the valve pocket, hence the heat-absorption area is reduced. The counterbore in the guide has been eliminated, which gives a larger bearing area and results in a more rapid heat flow and longer valve life. Moreover, the water jacket is extended farther down the guide.

The most notable change in connection with the powerplant is in the electrical system, which now comprises a new generator with an average maximum capacity of 28 amps., as compared with 19½ amps. last year; a voltage regulator, a new starting mechanism similar to that carried by other General Motors cars (with over-running clutch and automatic throttle advance), and a new mounting for the battery that is said to make it weathertight, dustproof, and more accessible.

In the carburetor the body, bowl cover, and air horn have been redesigned so that pressure variations are now vented into the air dome instead of directly into the bowl. The new one-piece choke valve is fastened to the choke shaft, but the choke lever floats between two torsion springs. When the choke-control rod is in the choke position, the valve is closed, but it opens with each engine revolution, varying the mixture to the momentary requirements. When the engine begins to fire, the valve is opened by the suction, even though the control is still in the "full-choke" position. As a result, the choke effect ceases when the engine starts.

The new clutch is designed around a diaphragm spring, which has the shape of a "dished" or concave washer, with 18 tapering fingers pointing inward. When the clutch is engaged, the disk is flat, while the entire rim bears against the pressure plate. Pressure of the throwout bearing on the inner ends of the fingers causes a diaphragm action, the outer ends of the fingers near the rim pivoting on the foremost of two fulcrums provided by two rings, one on each side of the spring. This action

(Turn to page 609, please)

Hypoid Rear Axle on Longer Wheelb

CHANGES in the Lincoln-Zephyr line for 1938 include an increase in the wheelbase from 122 in. to 125 in., redesign of the transmission which now has the shifting mechanism on the right side instead of on top, adoption of hypoid-gear drive for the rear axle, new frames for convertible models, several modifications in the engine design, and a number of additional mechanical refinements.

The space gained by increasing the wheelbase has been allocated to the hood, and the length of body at the dash. The engine has been moved forward, thereby reducing the distance the shroud over the flywheel housing and the clutch protrudes into the front compartment of the body.

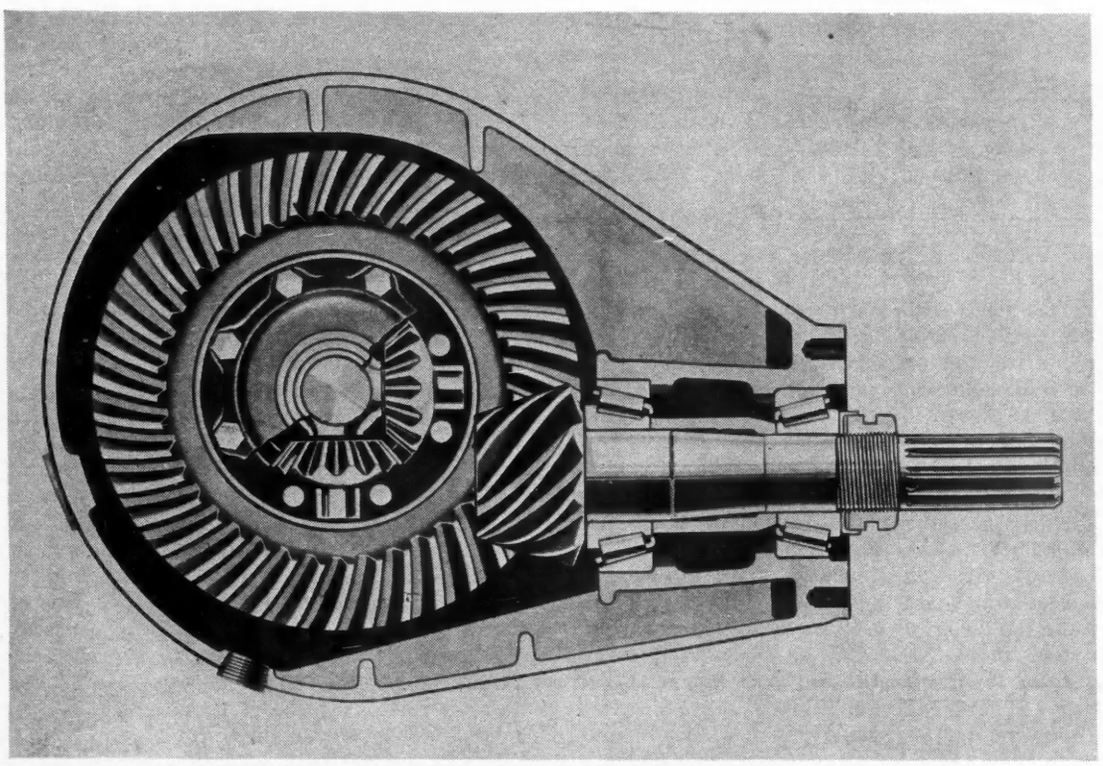
Reduction in the height of the floor tunnel in both front and rear compartments of the body has been made possible by redesigning the transmission and by adopting the hypoid drive. The shifting mechanism on the transmission is now on the right side instead of on top. A newly designed "Y" extension of the instrument panel extends down to the floor of the car. The gearshift lever is carried upward ahead of the instrument panel, where it comes through the left side of the "Y" extension, and thence backward to a convenient position. The brake lever is to the left of the steering column under the edge of the instrument panel, as formerly.

Adoption of hypoid gears for the rear-axle drive has reduced the tunnel in the rear compartment, which is now approximately 1.3 in. lower at its rear end than formerly. Redesign of the differential housing, with changes in allied parts, has naturally been made necessary by the use of hypoid pinion and ring gear in the rear axle. Straddle-mounting of the driving pinion has been discontinued. The rear axle is of the three-quarter-floating type, with full torque-tube drive. The rear-axle ratio is 4.44 to 1.

Several improvements have been made in the V-12 engine which is rated 110 b.hp. at 3800 r.p.m. Valve lifters now are of the self-adjusting silent type, the adjusting feature being operated from the lubrication system. Combustion chambers have been modified in shape. Engine mountings are of the compression-cup type, permitting elimination of the fore-and-aft strut rods formerly used to transmit torque and thrust to the frame and to maintain the correct longitudinal position of the engine.

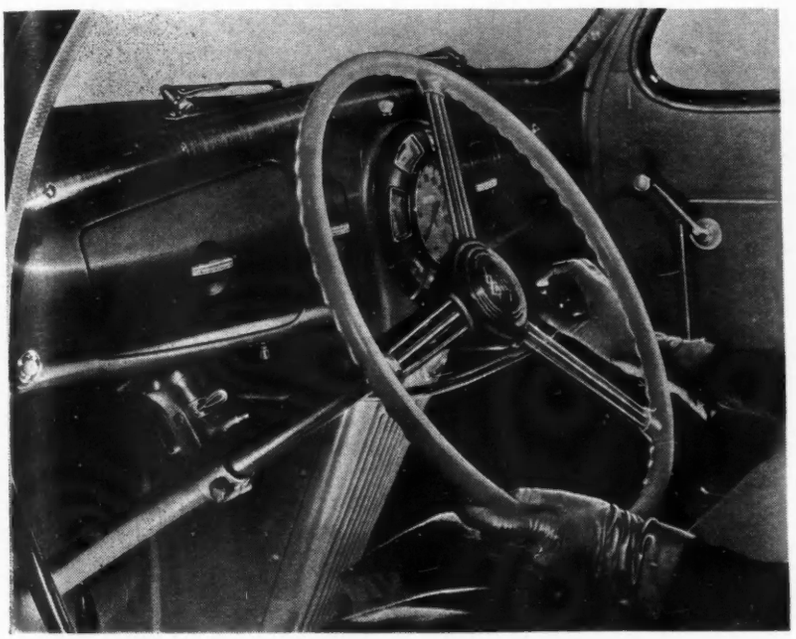
Direct metallic contact between the engine and the body-frame unit has been eliminated. A new radiator fan, said to have higher efficiency, is used. The crankshaft location for the fan is continued, the vibration damper being incorporated with it.

Strength and rigidity of the body-frame assemblies have been increased. Members under the floor have been increased in depth by approximately ½ in., and now consist of two channels placed one within the other to



The drive shaft of the New Lincoln-Zephyr for 1938 has been lowered approximately 1.3 inches at its rear end by the use of hypoid gears for the rear axle. Straddle-mounting of the driving pinion has been discontinued

el base for New Lincoln-Zephyrs



Driver compartments in the new Lincoln-Zephyr V-12 cars for 1938 have been enlarged. The transmission is located under the cowl, the housing has been lowered and the gear-shift lever moved out of the way of driver and front-seat passengers, to leave the compartment unobstructed

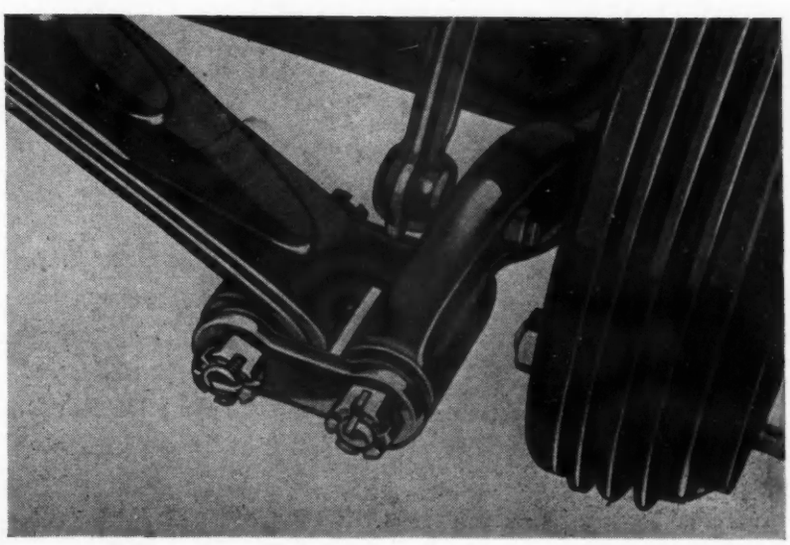
form approximate box sections. Road clearance has not been decreased. No change has been made in the basic construction of the closed body types, the entire structure, including body framework, floor, top and side panels, being welded into a single unit. The center of gravity of the car is lowered somewhat, due to the additional weight of the floor framework.

Frames for the new convertible coupe and convertible sedan models consist of main side-members of double box section, formed by placing one channel within another, then welding a plate to the edges of the upper and lower flanges. Side members have the same overall depth as the corresponding members in the closed body types. In addition, an X-member of similar construction is employed, providing four box section members near the center of the chassis, where bending stresses are greatest. Body door posts are reinforced by triangular plates, also welded to the chassis frame. The cowl and rear-end construction are essentially the same in the convertible as in the closed bodies.

Other mechanical changes include the use of angle-mounted rear spring shackles, in place of the transverse stabilizing rod and vertical shackles used in 1937 cars; a transmission synchronizer between second and high speeds which is intended to insure synchronization of the mating parts before engagement; a new 18-in. steering wheel (1 in. larger than formerly); battery located under the hood, and voltage-regulation for the generator.

Body interiors have been newly styled. The seat cushions are now equipped with small-diameter, closely-nested coil springs, each individually enclosed in a cloth bag.

Exterior body hardware is new, and all bodies will be finished in baked enamel. The hub caps also have been restyled.



One of the mechanical changes in the New Lincoln-Zephyr cars for 1938 is the use of angle-mounted rear spring shackles in place of the transverse stabilizing rod and vertical shackles used previously

Chrysler Lines Are Restyled for 1938

TWO lines comprise the Chrysler offering for the new season, the Chrysler Royal and the Chrysler Imperial, the latter together with its companion model, the Chrysler Custom Imperial. All are restyled and have a particularly striking front-end treatment. The Royal chassis is offered in two lengths of wheelbase, viz., 119 in. (which is standard) and 136 in. (for seven-passenger jobs). The Imperial chassis has a wheel base of 125 in., while that of the Custom Imperial (which is a seven-passenger model) has a wheelbase of 144 in.

A new zinc die-cast radiator grille with straight up-and-down lines makes an attractive front-end treatment. Lamps are fender-mounted. The hood is hinged at the center, in combination with fixed hood sides. In all transparent instrument panel sections glass has been replaced by Lucite, the new transparent molded plastic. A molded steering wheel and horn ring are standard equipment.

Mechanically the Chrysler lines are unchanged, except for detail improvements and refinements based on the service history of the past season. Such features as "floating-power" engine mounting, front independent suspension, all-steel bodies with one-piece steel top, direct-acting shock absorbers and hydraulic brakes are continued for the 1938 season.

Hypoid axles and rubber-suspended body mountings also are retained. The syncro-silent transmission has been improved by the use of the new blocker-type synchronizers for second and high-speed gears.

The overdrive transmission unit is standard on the Custom Imperial, optional at extra cost on the Royal and Imperial. It comes in automatically at between 35 and 45 m.p.h., by releasing the accelerator momentarily, and can be locked out by a control on the instrument panel.

Hydraulic brakes are continued, with vacuum power on the Custom Imperial, Centrifuse drums being used on all models. Drum diameters have been increased to provide greater stopping ability—to 11 in. on the Royal, 12 in. on the Imperial and 14 in. on the Custom Imperial. The parking brake is mounted on the rear of the transmission. It operates through cables and has a cast-iron drum. The hand-brake lever is mounted under the center of the instrument panel. To equalize lining wear, Chrysler uses "stepped" brake cylinders at the wheels, with a larger diameter bore for rear-shoe actuation.

Engines remain the same, except that the stroke has been increased ¼ in. on the Royal, ⅜ in. on the Imperial. The Royal engine is a six-cylinder L-head of 3⅜-in. bore by 4½-in. stroke (241.5 cu. in. displacement). It is rated 95 hp. at 3600 r.p.m. with 6.2 compression ratio and cast-iron head. With optional aluminum head and 7.1 compression ratio, the engine is rated 102 hp.

A new camshaft with earlier opening and closing of the intake valves now is a feature of the Royal engine. This, combined with large valves and ports, improves the power output at lower speeds and is said to increase the acceleration. Full-length water jackets also are a feature of this engine, and the main oil gallery is immediately below the bottom of the jacket, which helps to cool the oil.

The Imperial engine is an eight-cylinder L-head of 3¼-in. bore by 4½-in. stroke (298.6 cu. in. displacement). It is rated 110 hp. at 3400 r.p.m. with cast-iron head and standard compression ratio of 6.2. It has the same rating as last year but operates at a lower speed and with a decreased compression ratio. With special aluminum head, the Imperial engine has a rating of 115 hp. at 3400 r.p.m. with a compression ratio of 6.5.

A new camshaft with earlier opening and closing of the intake valves, and increased stroke feature the 1938 Royal engine

The Custom Imperial remains the same, an eight-cylinder L-head of 3¼-in. bore by 4⅞-in. stroke (323.5 cu. in. displacement). It is rated 130 hp. at 3400 r.p.m. with aluminum head and a compression ratio of 6.5. An optional compression ratio of 7.45 with a special aluminum head boosts the power to 138 hp.

Features common to all Chrysler Gold Seal engines include anodized aluminum-alloy pistons with four rings; alloy-steel exhaust-valve inserts, vibration damper; toothed-chain camshaft drive; oil-bath air cleaner; oil filter, crankcase ventilator, and large ventilated generator with a maximum rating of 28 amp. fully controlled by voltage and current regulator.

Single-plate, dry, ventilated clutches are continued. The diameter of the Imperial clutch has been increased from 10 to 11 in.

New X-type frames are used. The strength of the front end of the frames has been increased by the use of a new cross-member. The channel members of the X are tapered from where they join the side members to the center, resulting in a center section of unusual depth. Gusset plates riveted to the top and bottom add strength to the center section.

The cross-member which supports the rear of the engine is riveted to members which join with the front cross-member, form box sections with the side-member, and extend to the members forming the front part of the X. From this point short reinforcing cross-members extend between the rear members of the X and the frame side-members. The rear of the X members are extended along the side-members to form box sections over the rear axle. There are two cross-members at the rear of the frame.

Tapered rear leaf springs of "Amola" alloy steel are continued, with silent "U" thread shackles at the rear ends and rubber-cored bushings at the front. The rubber-mounted front sway-bar is continued on all models. In addition, the Imperial and Custom Imperial feature a new transverse stabilizer at the rear. One end is pivoted to the right side of the rear cross-member directly behind the rear axle, the other to the spring seat of the left rear spring.

The steering gear is of the worm-and-roller type, as before, and is rub-

DeSoto Improved in Chassis and Body

(Continued from page 585)

ber-mounted. On the Royal and Imperial individual tie-rods connect from the pitman arm. On the Custom Imperial a cross drag link connects to an intermediate arm which operates the individual tie-rods.

Safety glass is standard all around. Airwheel tires with ribbed tread in front are standard on all lines and provide freedom from tire noise with independent front springing. Lifeguard inner tubes, consisting of a heavy-duty tube with a secondary inner tube served by the same valve, are standard on the Custom Imperial and are available at extra cost on the Royal and the Imperial.

All-steel bodies with a one-piece steel top are continued. In sedans, an X-brace located behind the rear seat back is welded to the body sides to provide additional rigidity. New sliding block-type dovetails are said to eliminate door rattles. The bodies are fully insulated thermally and acoustically. The steel roof, upper rear quarter and cowl sides are insulated against heat and cold and as a preventative against noise or drumming.

The insulation is carefully cemented to the metal. A similar type of insulation is used on the upper side of the cowl. The steel floor, too, is effectively insulated with a heavy material laid on the floor before the body is passed through the bake ovens. It extends from the front of the front seat to the extreme rear of the car, including the trunk or luggage compartment. The heat of the bake ovens softens the asphalt base of this material so that it follows every contour of the steel floor.

Door panels and side panels are thoroughly insulated, and a rubber seal is used on the front edge of the front doors. A heavy coating of a gum-like insulation is sprayed on the under side of the rear deck lid, in addition to the heavy felt padding between the two metal panels which make up the rear lid.

The dash is lined with thick insulating material and finished with an attractive facing panel. Felt insulating pads are used under the floor coverings in the front compartment and under the carpet in the rear compartment of sedan models.

Removable floor sections are insulated with felt and sealed around the edges to keep out dust and drafts and to prevent rattles. Openings around the pedals are sealed to prevent engine heat or cold from entering the body.

The luggage compartment is provided with a rubber seal to prevent the entrance of dust or water, and the sides and floor of the compartment are lined to protect luggage as well as to improve the appearance.

mounting of the steering-gear housing to the frame.

In the friction clutch, a baffle plate prevents oil and water vapors from reaching the surfaces of the driven disc, while a grooved facing aids in cooling and breaking down vacuum. The clutch is ventilated and has a ball-bearing release. Its pedal action has been softened. Easier gear shifting is the object of a new "blocker-type" synchronizer in the transmission. The so-called "gas-saver" transmission remains available at extra cost.

In the steel bodies with one-piece steel top, in addition to the insulating material used on the body panels, steel front, and steel top, on cowl and rear luggage compartment, insulation is now applied by spraying to the door panels.

A larger, ventilated generator, with a capacity of 28 amperes, takes care of extra demands due to car heaters, radio, etc.

Football - NEW CARS - sure indications of Fall. And for the successful performance of either - PROTECTION is vital.

In football, there is the all-important man on the offense who protects the ball carrier, who blocks out trouble, who SMOOTHS the way.

In car operation, it is "dag" colloidal graphite, with its teammate oil, which is on the offense against wear and friction. Forming self-lubricating graphoid surfaces on engine friction parts, "dag" colloidal graphite smooths the way for oil. It protects the metal parts during moments of extreme temperature and pressure and aids in the maintaining of full film lubrication.

Ask your oil supplier about his colloidal-graphited oils today and write us for our descriptive booklet 500 giving in detail data concerning "dag" colloidal graphite.

ACHESON COLLOIDS CORPORATION
PORT HURON, MICHIGAN

dag
COLLOIDAL PRODUCTS

COLLOIDAL GRAPHITE

DAG COLLOIDAL GRAPHITE IS A 100% AMERICAN MADE MATERIAL

ACHESON COLLOIDS CORP., PORT HURON, MICH.
Please send gratis, story on "dag" Colloidal Graphite.
NAME .....
ADDRESS .....

What Designers Have Done

(Continued from page 558)

There is not much new in engine lubricating systems this year. Chrysler has introduced a new system of oil-temperature control which is notable for its simplicity. Oil is distributed to the various bearings through a drilled passage in the crankcase wall. The engines have "full-length" water jackets, and the oil "gallery" or main header is located immediately below the bottom of the cylinder jacket, so opportunity for heat exchange between the oil and the cooling water is afforded without any extraneous devices.

Instead of relying on a slinger to prevent oil from working its way out of the crankcase and into the clutch housing past the rear main bearing, Cadillac now makes use of an oil seal of asbestos composition at this place. In the Packard Junior six- and eight-cylinder engines, the valve tappets are lubricated from the pressure system. These engines also are provided with a two-stage oil filter. Normally all of the oil moved by the pump passes through the filter, but if the filtering element becomes choked, by reason of failure of the owner to renew it at the proper time, the oil is by-passed and lubrication is not interfered with.

A transformation has been going on in engine enclosures for some years and it almost seems as though the old conventional hood with three longitudinal hinge joints was "on the way out." On a good many cars the side walls of the engine compartment are bolted in place and are removed only when major service operations are to be performed. What was once the engine hood has been reduced practically to a lid, to which the term "alligator-hood" has been applied. The fixed sides of the engine compartment also serve as radiator bracing members and eliminate the need for radiator tie rods.

Changes made in clutches have for their object a reduction in the pressure required to release them and to prevent oil from getting onto the clutch linings and reducing their friction coefficient. Chevrolet has an entirely new clutch which makes use of a single diaphragm-type of spring, instead of nine coil springs. Redesign of the Chevrolet clutch has made possible a reduction in the average pedal pressure from 33 to 25 lb., as well as a reduction of the weight by 5 lb. This, coupled with a reduction in flywheel weight of 5 lb., will make the engine "livelier" or more responsive to the throttle. A number of changes have been made in the De Soto clutch. It has been provided with a baffle plate designed to keep oil off the clutch facings, and these facings are grooved, which is said to help keep the lining cool and to break down the vacuum which tends to form. Hudson has increased clutch capacity by increasing the number of clutch springs, while the Studebaker President now carries the Long semi-centrifugal clutch which, by relying in part on centrifugal force to keep the clutch in engagement, reduces the pedal pressure required for disengagement under normal conditions, when the throttle is released.

Undoubtedly the most important development in the field of transmissions in the course of the year is the introduction of an automatic-shift transmission by General Motors as optional equipment, first on the Oldsmobile Eight and now also on the Oldsmobile Six and the Buick 40. The first announcement of this transmission dates back to last May. It may be recalled that this transmission is of the planetary type and is combined with a sliding-type reversing gear which is hand-

LITTELL

SPEED with SAFETY

HEAVY-DUTY UNITS!

ILLUSTRATED are the Littell No. 7-30 Double-Rack and Pinion Feed — Power Driven 7-Roll Straightener — Heavy-Duty Scrap Cutter — and Power-Driven Automatic Centering Reel. A very heavy-duty Feed with large shafts. Designed for strength and rigidity.

Built to handle hard aluminum stock .102" thick x 27" wide in coils, and 1/4" thick x 27" wide in strips. Automatic Release Brake permits feeding 1200" per minute. Automatic Lifters lift rolls on both sides at each stroke of press, to permit pilots to adjust stock to correct position in case feed is inaccurate.

Feed is fitted with a Heavy-Duty Scrap Cutter operated from crankshaft of Press. A No. 15 Power-Driven Automatic Centering Reel winds off loop so Feed does not pull directly from coil but from loop. When loop is wound off it pushes against paddle, automatically stopping Reel.

Littell makes a complete line of Automatic Roll Feeds, Automatic Centering Reels, Punch Press Air Valves and Universal Air Nozzles.

Ask for Bulletins.

F.J. LITTELL MACHINE CO.

4155 Ravenswood Ave., CHICAGO, ILL.

controlled. Changes of gear are effected by means of oil put under pressure by a dual gear pump inside the transmission. Admission of the oil to servo units that effect the changes of gear is controlled by a centrifugal governor, and the action of the governor is in turn under the control of the driver, through the intermediary of the accelerator pedal. By pressing down the accelerator pedal more or less, the driver can control the speeds at which changes of gear—both up and down—occur automatically The transmission has four forward speeds and is used in combination with a low-reduction rear axle.

Overdrives either are regular equipment or can be had as extras this year on Chrysler, De Soto, Graham, Hupmobile, Nash, Pierce-Arrow and Studebaker cars. Power shifting units with selective control are provided or offered as extras by four makers—Hudson, Graham, Nash and Studebaker. Two systems are involved and both make use of the inlet-manifold vacuum.

In considering the desirability of an automatic transmission, it must be remembered that it not only eliminates all of the hand-shifting that is ordinarily done with the conventional three-speed transmission, but has other advantages as well. Previous attempts to introduce four-speed transmissions on the American market, in combination with low-reduction-ratio rear axles—which cut down the engine speed and increase the fuel economy—failed, evidently because the American driving public dislikes the additional shifting required and does not sufficiently appreciate the advantage. But with the four-speed automatic-shift transmission the advantages are secured without the need for any additional hand shifting. Besides, the automatic transmission clears the front compartment of the conventional shift lever and, with the removal of the transmission-mounted brake lever already accomplished, it leaves the front compartment entirely unobstructed, a feature that will certainly be appreciated by drivers—especially the larger and less agile. This latter advantage, of course, can be had also without going to the complication of automatic transmissions, and two makers, Cadillac and Pontiac, this year offer gear-shift levers mounted on the steering post underneath the wheel. It may be of interest to recall in this connection that as far back as 1903 Pierce-Arrow built a four-cylinder car with the shift lever mounted in this position, but that, of course, was with a progressive-shift transmission and the shift lever had a plain rocking motion in a single plane. With the selective transmission the lever must be capable of motions in two different planes at right angles to each other, and that makes the design problems more difficult.

Three makers now fit transmissions with the two shafts in the same horizontal plane, an arrangement that has been used a good deal in truck transmissions in the past. So far as operation is concerned, that is exactly the same as with a transmission having the secondary shaft located directly below the primary. The advantage of this type of transmission for passenger cars is that the control or shifting mechanism is located at the side of the housing and the housing therefore need not encroach upon the driver's compartment, making a tunnel therein unnecessary.

The use of hypoid gears for rear-axle drives is still growing, and 32 out of 48 models listed this year are equipped with them. Packard, the pioneer of the hypoid-gear drive, has made a number of improvements in the mounting of the gears this year. With this type of gear it is very essential that both the pinion and the gear be very rigidly mounted, so that the conditions of mesh cannot change materially. The rigidity of the mounting can be in-

They leave it up to Maehler!
MAEHLER HEATERS
MAEHLER CORE OVENS
MAEHLER OVENS
WHY worry about your automotive heating problems? Let Maehler step in and take the load off your shoulders. It's the job of Maehler engineers to see that you get maximum production capacity.
Through two decades Maehler equipment has more and more become a part of production in the nation's greatest automotive plants.
A complete line of heating equipment to meet every requirement—Continuous Ovens... Air Heaters... Core Ovens... Air Draw. Write to the
PAUL MAEHLER COMPANY
2200 West Lake Street, Chicago, Illinois

creased by preloading the anti-friction bearings. This is accomplished in the Packard by inserting a spacer with a very thin section between the two bearings on the pinion shaft. When the bearing-mounting nut is tightened up, this section buckles and subjects the bearings to a preload which depends only upon the section of the spacer and the elastic limit of its material, and is independent of the exact position of the nut. Cadillac also has made a change in its hypoid driving gears, having increased the spiral angle from 45 to 50 deg. Hudson has brought the rear-wheel rims further inward and thus closer to the mounting flange, to decrease the overhang of the wheels and the consequent bending moment on the axle shafts.

There is little change to report in connection with braking systems. On some of the Chrysler lines the brake diameter has been increased, brake drums have been rendered more rigid by deeper radial flanges, and the braking surface is given a finer finish, which is said to reduce lining wear and prevent "brake knock."

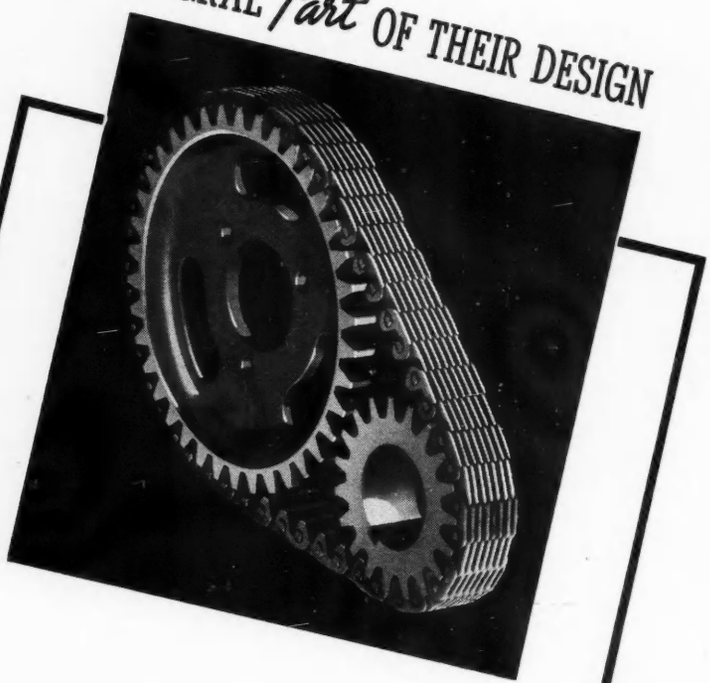
There is no change this year in the number of front independent suspensions. Various improvements have been made to the several systems that have been in use for a number of years. Thus Studebaker, which uses a transverse leaf spring at the front, now restrains this spring at the center where it connects to the frame, instead of pivoting it to the frame. Packard, which uses coil springs at the front, now places a rubber cushion under each of these springs to prevent metal to metal contact at these points. Pontiac, Oldsmobile and DeSoto, with independent front suspension on coil springs, now use hardened-steel replaceable bushings with (synthetic) rubber oil seals in the control arms. DeSoto also has stiffened the upper control arm and softened the rubber bumper inside the spring.

The most radical change in rear suspensions this year is the adoption of coil springs by Buick. Buick continues its torque-tube and has added brace rods which extend from the ends of the axle housing to the forward end of the propeller-shaft housing or torque tube. The coil spring is interposed between a spring rest extending back from the axle tube and a corresponding spring rest on the under side of the frame rail. Transverse stability of the chassis with respect to the axle is assured by a transverse stabilizer tube whose two ends are pivoted to the frame and the axle housing respectively. Such transverse stabilizers are becoming popular also in combination with ordinary leaf-spring rear suspensions. They are this year found also on all Cadillac models, the LaSalle, the Chrysler Imperial and Custom Imperial, and the Packard. An incidental advantage of the use of coil springs for rear suspension on the Buick is that it has eliminated numerous chassis lubrication points.

Chevrolet now mounts its rear springs so they are completely insulated from the axle housing; that is, all motion transmitted from the axle to the springs must pass through rubber and is therefore highly damped. Packard has adopted rear springs with controlled friction characteristics, the leaves being separated by bedded buttons at the tips and the springs encased in unpacked metallic covers. Rubber-floated shackles are used at both ends of these springs. In the Packard Junior lines, there are no less than four different connections between frame and rear axle: The leaf springs, shock absorbers, a sway bar, and a transverse stabilizer.

A number of manufacturers have further stiffened their chassis frames, but no new principles have been introduced. There seems to be a difference of opinion as to the best method of

AN INTEGRAL *Part* OF THEIR DESIGN



● Morse is ever appreciative of that continued acceptance which, for twenty-five years, has made Morse Silent Timing Chains an integral part of the design of so many cars. Unseen and unheard, Morse Silent Timing Chains contribute their part toward smooth, quiet, perfectly synchronized motor operation.

MORSE SILENT TIMING CHAINS
MORSE CHAIN COMPANY ITHACA, NEW YORK . DETROIT, MICHIGAN
DIVISION OF BORG-WARNER CORP.

mounting the body on the frame. An increasing number use outriggers, and in some cases the body is now supported on these outriggers through the intermediary of rubber spools. **DeSoto,** on the other hand, has widened its frame and now mounts some bodies directly on the side rails, which is said to offer the advantage that it gives a more rigid support for the front seat. Buick secures the body to the frame at the rear end only at the middle of the cross member. This gives something of the effect of a three-point support, allowing the rear end of the frame to distort without unduly stressing the body.

On Chrysler lines the steering gears are now mounted on the frame on rubber, so as to prevent the transmission of frame vibrations to the driver's hands. The type of steering wheel with flexible wire spokes and a molded, reenforced rim is being widely used, and many cars also have molded horn-sounding rings on the steering wheel and concentric therewith. Oldsmobile has a special design of steering wheel this year in which only two spokes extend radially, in opposite directions, from the hub, and connect to the rims through the intermediary of sector-shaped extensions, so that there are four junctions with the rim. The object is to minimize the obstructions in the way of the driver's view of the instruments, which are grouped on the dash directly in front of the steering wheel. Chevrolet now secures the steering wheel to its shaft by means of serrations (instead of a Woodruff key) one advantage of which is that it enables the driver to adjust it to the spoke position most convenient to him. Reversing a trend which has obtained for a number of years, Plymouth has this year reduced its steering gear ratio, but has been able to do this without increasing the steering effort required, by so inclining the king pins that their axes when produced come outside the areas of contact between wheels and ground, and by providing a roller bearing on the king pin. Pontiac has raised its steering gear relative to the frame, so as to ensure more ground clearance under the pitman arms.

It has seemed to this writer that in the past, designers of cars with V engines have sometimes made the engine compartment longer than necessary to accommodate the engine, in an evident endeavor to allow for an inclination of the purchasing public to judge the power of a car by the length of its hood. Such measures, of course, are absolutely unnecessary where the engine carries as many as sixteen cylinders and rates only slightly below 200 horses, and Cadillac has succeeded in shortening the engine compartment and wheelbase length of its new V-16 by approximately a foot. There have been a few other changes in treads and wheelbases. In treads, of course, the tendency continues upward, because of the greater space required by low-pressure tires and the desire to afford commodious accommodations for three in the rear seat. DeSoto has increased its wheelbase 3 in., as has Ford in its Lincoln-Zephyr.

The practice of mounting headlights on the fenders is increasing, being followed by Chrysler, Oldsmobile and Pontiac, among others. DeSoto has joined the growing ranks of those makers who "nest" the headlamps in the fenders, a practice that has been shown to decrease air resistance.

On all of the Chrysler lines the top line of the windshield is carried higher this year, to increase the driver's field of vision upwardly and make it easier for him to see traffic lights over the center of the road, for instance.

Muffler design remains unchanged on the whole. A straight-through muffler has been adopted for the Hudson Six, and because of the rapid passage of the exhaust through it, less heat is

MOVING!
November 1st from
2701-2709 N. Pulaski Rd.
CHICAGO
TO

Aluminum and Zinc Base
DIE CASTINGS

—of the same fine quality will be provided for passenger car and parts manufacturers at our new address.

However with 83,000 square feet of floor space in our new one story saw-tooth type of building, our service to you will be consistent with our increased modern equipment. An opportunity to present to you the benefits of our new and thoroughly modern facilities, will be appreciated.

PARAGON DIE CASTING CO.
5851-5901 Dickens Avenue
CHICAGO, ILLINOIS

DETROIT • INDIANAPOLIS • MILWAUKEE • CLEVELAND

radiated by the muffler and trouble from overheating of the driver's compartment in hot weather is avoided. Cadillac, to make it possible to drop its frames lower without decreasing the ground clearance, now mounts mufflers transversely at the rear of the car.

The "bold-front" radiator grille profile, which made its appearance last year, seems to have caught on, for a good many cars this year have the grille front line either vertical or even protruding, instead of receding at the top. This has lengthened hood lines. There does not seem to be much change in body design proper, although soundproofing has been carried further and various items of equipment have been redesigned from the standpoint of greater convenience or increased safety. Packard lays stress on the use of no less than eleven different sound-deadening materials, and Chrysler cars, which also are insulated more thoroughly than heretofore, have seals around all openings. On the Chrysler lines the front-seat adjustment has been changed. The adjusting lever now is located in a more convenient position, forward movement of the seat is accompanied by a rise, and a device is provided which assures parallel movement of the seat and prevents "sticking." The idea behind the compound adjusting motion of the seat is that a driver who needs the seat further forward so the pedals are within convenient reach, also needs it higher for optimum vision through the windshield. Nash offers a "conditioned-air" system as an option, by which the air entering the body is heated when required, filtered, and deprived of some of its humidity in damp weather. With this system all air enters through the cowl ventilator and at all other openings in the body the flow is always outward, due to a slight overpressure inside.

Graham has a new type of concealed ball-and-socket-type door hinge (illustrated elsewhere in this issue), Chrysler a new sliding-type of door "dovetail." There is a general movement of instruments from the center of the cowl board, where they were located when they were first grouped on a separate panel, to directly in front of the driver, where he can read them through his steering wheel without turning his head. Plymouth and DeSoto now have the cowl lights shine through the dial plates from in front, so that the numerals stand out in light at night. The mounting of bodies on outriggers provided with rubber spools has been referred to already.

Chevrolet has made some changes in the stowing facilities of its bodies. The spare wheel, which was formerly carried in a horizontal position at the bottom of the rear trunk, is now carried in a vertical position therein, thus making the luggage space materially deeper. Tools are also provided for in the trunk, there being a separate compartment for them just inside the rear edge, where they can be gotten at by lifting a wooden lid. This certainly seems preferable to having them below a tight-fitting front-seat cushion.

Reference has been made already to the efforts on the part of designers to reduce the physical effort required in operating the cars. The introduction of automatic-shift and power-shift transmissions, of course, is a step in this direction. Others include the development of the new Chevrolet clutch requiring 24 per cent less pedal pressure, the use of an "over-center" helper spring for the clutch pedal on Buicks and Pontiacs, and the adoption of the Long semi-centrifugal clutch for the Studebaker President. In one make the starter-control mechanism has been redesigned so it requires less pedal pressure. Chevrolet has the throttle interconnected with the starter button, so that when the starting switch is closed the throttle is opened automatically to the optimum position for starting.

YOU'VE got a good-sized investment in every man trained in your plant. So long as he is at his machine, working, he's valuable to you. At home, laid up with Oil Dermatitis, he's a total loss. Plainly, the thing to do is to protect him from this dreaded skin disease. The cost is secondary. You can easily guard your men against Oil Dermatitis with Derma-San. One pint, added to every 35 gallons of cutting lubricant kills pus-forming germs before they attack your workers. Derma-San protection is worth many times its cost. Order a drum—today.

Derma-San is also ideal for all general plant sanitation

The HUNTINGTON LABORATORIES Inc.

DENVER HUNTINGTON, INDIANA TORONTO

Buick has combined the automatic choke control with the vacuum-controlled starter switch. It may be recalled that on the Buick, starting is effected by pressing down on the accelerator pedal, which closes the starter switch provided the engine is at rest. If the engine is already running the suction in the inlet manifold prevents closing of the circuit. Presumably this same vacuum chamber acts to hold the choke valve open whenever the engine is running normally. Chevrolet now also has an automatic choke, but control of the choke is by the inlet vacuum instead of by a thermostat.

One of the novelties last year was the windshield defroster, which made its appearance almost simultaneously on a number of cars. This year the design of these defrosters has been modified somewhat, and their capacity increased, which would indicate that in their original form they were not quite adequate under really severe conditions. In the way of additional equipment, Studebaker has made the Hill-holder standard on some models, and Chevrolet furnishes a water-temperature gage on deluxe models. Chrysler furnishes blow-out-proof "Lifeguard" inner tubes on the Custom Imperial as standard, on other models at extra cost.

British Show Report

Black and dark blue were the most popular colors shown at the opening of the London automobile show Oct. 14 at the New Earls Court, with beige and buff next and maroons and reds slightly more popular than last year, according to color experts of the Duco Color Advisory Service. Grays dropped somewhat in popularity, while light colors and contrasts were very much in evidence.

It was noticeable that there were very few changes in design, no radical models, and streamlining practically discontinued. No touring cars were shown, but there were more of the convertible body types with a fair number of small sport cars. Chromium and other types of plating were approximately the same.

A total of 471 cars were on exhibition, an increase over a year ago. Of this number, 131 cars were by British custom body builders, while for the first time no foreign body builders were represented. However, there were 29 English, eight Canadian and American and 13 continental manufacturers showing 31 English, 17 Canadian and American and 18 continental makes of cars. In addition there were 14 trailer manufacturers exhibiting 57 models, including one American manufacturer.

All of the British makes of bodies, with the exception of one, were finished in a nitrocellulose lacquer, but many of them had a well-known synthetic resin finish on the fenders. The one manufacturer who did not use a nitrocellulose lacquer painted his cars completely with a synthetic resin finish.

Generally, the interior of the American cars were upholstered in whipcord or a similar cloth, but most of the British and continental cars were upholstered in leather. A small percentage of the models shown used a pyroxylin-coated fabric. About 5 per cent of the cars were equipped with safety glass and approximately the same number used plastics in one way or another. One manufacturer presented an innovation in windshields which dispenses with the two front columns through the use of a plastic and thereby eliminates those blind spots for the driver.

Views Dealer Laws

Expressing the belief that all dealers are not benefited by more laws governing the conduct of their business, R. H. Grant, vice-president of General Motors, advised 4000 Pontiac dealers assembled in national convention in Detroit, to "be sure you are right before you participate in joint action asking for greater legislative restrictions."

"Don't rush in but watch and see what happens before taking any action," he said. "The answer is good business management. The good dealer can get along without laws. I am not opposed to legislative assistance, but it must be lasting to be good."

COLD FINISHED BAR STEELS

When high powered automobiles are forced to maximum speeds, they develop stresses that ordinary steels cannot sustain with safety. Service hazards resulting from hidden weaknesses can be avoided by fabricating vital parts from B&L Cold Finished Bar Steels. They are produced to the high standards of accuracy, uniformity and quality so necessary to the precision workmanship and super-strength in automotive construction. Our experience in developing special steels for the automobile industry may help you on problems involving applications of Cold Drawn Steel—we invite your inquiries.

COLD DRAWN BARS ● GROUND SHAFTING ● ULTRA-CUT STEEL ● SPECIAL SECTIONS ● ALLOY STEELS

BLISS & LAUGHLIN, INC.

HARVEY, ILL. *Sales Offices in all Principal Cities* **BUFFALO, N.Y.**

The Tourist Trailer Industry

(Continued from page 580)

our survey deprecated the strength of this movement. There was no conclusive evidence that metal had proven superior to other materials and it seemed to us rather that metal would come to the fore only as the result of strenuous promotion, or because industries which were accustomed to working with metal and had surplus manufacturing facilities came to be the mass producers. But trailer manufacture is still an infant business and as such is not tempting to the mass producers. There is nothing on the horizon to warrant large outlay for jigs and dies. And therefore we say that two things in question last year are settled for the time being. Automobile companies are not going to be the makers of trailers and metal panels are not to lead in materials.

Early this year there was a good deal of attention paid to cutting production costs. The most obvious move was to follow automobile practice and install assembly lines and so coordinate unit labors. But the trailer being what it was, the lines served perhaps best as affording good publicity pictures. Virtually every job on the lines was getting custom treatment and the hoped for economies did not materialize.

Nevertheless, there are economies inherent in the practice if they can only be realized. Rather than abandon it, it should be adapted to the peculiarities of the product. So we find Palace Travel making the equipment quite separate from the shell, and claiming that by so doing they can run their jobs through with standardization and let the custom part of it—the fittings—be handled separately. Customers will be given quite a choice of equipment which has been so designed that some latitude in its placing is permitted, while retaining a balanced vehicle.

How to win Sales and influence Quotas . . .

IN ONE EASY LESSON

Suppose you're a salesmanager or a salesman or maybe even the Boss. And suppose that you're in the midst of the annual struggle to decide *what* to give your customers *this* Christmas.

And suppose, just about the time you're ready to go nuts, you happened to think of giving subscriptions to ESQUIRE as gifts. Nine times out of ten* you'd realize the struggle was over and you'd grab your list and dictate a quick memo to the purchasing department.

*Suppose you're the one out of ten who doesn't know instinctively that ESQUIRE Gift subscriptions are the answer to the problem. In that case we'll include a few sales arguments for you to use on yourself.

Being sales-minded you know that the product is its own best argument. Look a copy of ESQUIRE over carefully. A few minutes with the magazine will convince you.

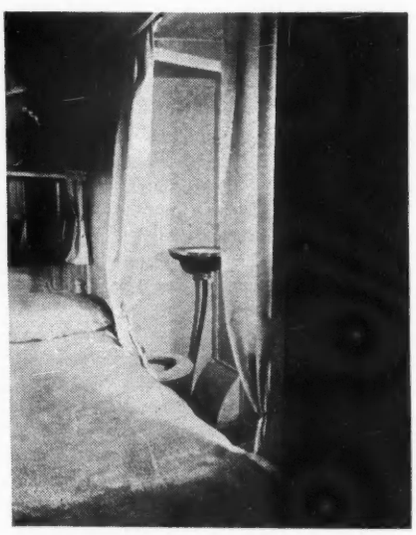
PRICE: . . Reasonable.

SUITABILITY: Universal. It's the "Magazine For Men" but, in case you didn't know, women like it, too.

VALUE: . . ESQUIRE has the impressiveness of bulk, the universal appeal of lavish color, the interest of splendid articles and fiction, the presentations of leading advertisers, authoritative fashions for men, and portfolios of the work of leading contemporary artists.

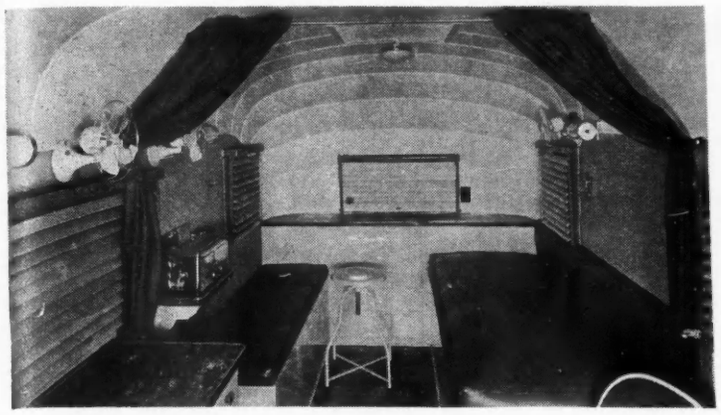
WILL IT DO THE JOB? . With the arrival of ESQUIRE every month your customer will be reminded of the donor—a welcome Christmas gift split into twelve parts and spread out over a year.

For complete information about Esquire's Gift Plan and Special Rates, write immediately to Christmas Dept. 107, Esquire, 919 Michigan Ave., Chicago, Ill.



In the de luxe Alma trailer a toilet with yacht-type wash basin is optional equipment. When this installation is not desired the space can be used for wardrobe.

The matter of equipment is being given maximum attention in the new models with chassis and frame construction being retained with practically no modifications. This is due partly to the necessity of working off inventories, partly to being satisfied with existing construction. More thought is being given to lightening the weight on the drawbar with few solutions appearing. Palace Travel retains its third wheel and claims that it has proved thoroughly satisfactory. Saginaw Stamping & Tool Co. has applied its self-aligning third-wheel, long used on its cart-type trailer, to a house trailer chassis. By using a wish-bone on the



A mobile medical clinic in an Aerocar trailer shell illustrated the many specialized uses which are being found for trailer applications.

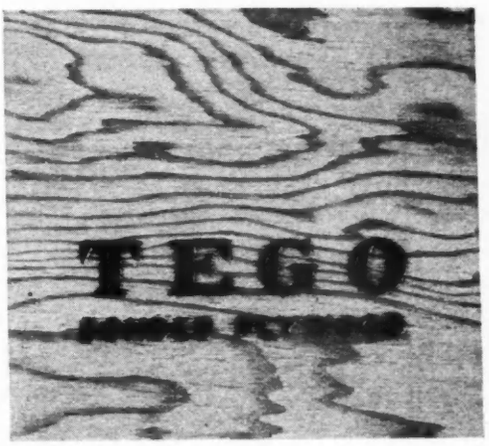
front end, coupled with a semi-elliptic spring, it is possible to adjust the load carried on this third wheel, either to free the tow car from all load or to give it partial load.

All sorts of variations in hitches are coming on the market. Travelcar has brought out one which enables the driver to hitch up without any assistance. When the tow car is backed up to the trailer a wedge-shaped, swiveling tongue engages in a fixed slot and elevates the trailer from the ground. The shape of the tongue gives a considerable range of angles of approach so that it isn't necessary to have tow and trailer absolutely in line to make connections.

There is some evidence that trailer manufacturers are desirous of suiting their product more closely to the work they have to do. Aerocar continues to put highly specialized equipment on the road, designed for commercial displays, medical work, ambulances, etc. While commercial work has not been given the prominence accorded the house trailer, the business is substantial and growing very steadily. Apropos of this field, Saginaw Stamping is building a freight conveyor on its self-aligning, third wheel chassis. The idea behind this is somewhat new. Being very light in weight, the trailer can be towed by a small pick-up truck and the outfit is designed for companies whose large loads are too infrequent to justify tractor-trailer units where the tractor is idle most of the time. In this combination the tow car is a load carrying unit at any time.

Covered Wagon has announced a Cottage model of trailer, but it does not represent the 1938 line. Rather it is an attempt to feel out possibilities of trailer housing. Straight lines are employed to give maximum headroom and the interior appearance of a home. Walls are double and made of Homosote, a material heretofore little used for trailers, but long on the market for small buildings, camps, chicken houses and the like. Equipment is built in, but buyers have a choice of living room furnishings.

When last year's survey was made, some manufacturers claimed a solution to the housing problem. No such claims are made today. Trailers are being sold for use as homes, but it is recognized



TEGO-BONDED

Plywood for Exposure

No NEED to forego the economy and advantages of plywood any longer.

"Tego-bonding" is producing plywood that for years has met all demands of durability and outside exposure. Scientifically assembled, it is by nature immune to humidity, cold and boiling water, and mold, due to the nature of its resinous film bond—Tego Resin Film.

Tego-bonded plywood is at home on land and sea, indoors and out, in any climate.—*The Resinous Products and Chemical Company, Inc., Philadelphia, Pa.*

RESINOUS PRODUCTS

Palace Travel Coach Co. provides shells in which all equipment is optional, enabling the purchaser to furnish his new trailer as he would a new home.

that such purchases are made as emergencies, solely because of high rents or housing shortages in specific localities, and that adequate housing would end their home use promptly. Vacation and travel are now being stressed, and where home trailers are being sold they are usually merely elongated models of the travel type with a little more comfortable arrangement of equipment.

And at what price will the new models be sold? Higher than last year whenever it is possible. Some producers have already announced increases. It is quite well recognized that prices are already high enough as far as the consumer is concerned, but profit margins have been too slim for operating health. In many cases net profits per trailer have not exceeded $25. Those who figured that unprofitable operation with small output could be changed for the better by increasing production, found that they merely multiplied losses, hence from now on there will be more attention paid to making each unit yield an adequate return and less to the blessings which are supposed to come from bigger business.

Time alone will unscramble the legislative troubles which are a serious deterrent to going forward, but a stronger, better financed national association intends to see that the industry gets a hearing and fair treatment. Any strength derived from consolidating of positions will help in this combative work.

On the face of it the trailer industry looks unhappy, but the face conceals the real substance that lies behind. The shake-down process, painful as it is and falling like the rain upon the unjust and the just, is nevertheless a wholesome thing. It hasn't put the sound operator out of business; it has merely created temporary difficulties, and so far as it acts as a purge it will not be at too big a price. Shorn of ballyhoo, trailer making begins to take on the color of real business where overhead is something tangible and not a casual reference to blue sky.

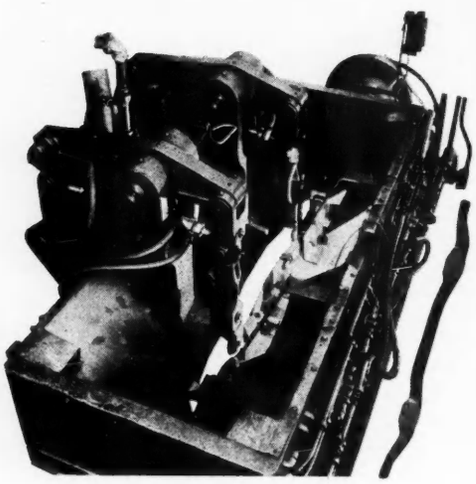
Hudson Service Men Meet

Over 250 service executives and members of the factory personnel of the Hudson Motor Car Company and its distributing organization have concluded a two-day convention in Detroit. The meeting was held under the supervision of T. H. Stambaugh, director of national service operations. During the course of the meeting, which was attended by parts and service executives of distributors from all over the United States and Canada as well as zone parts and service men, regional service supervisors and the factory staff, addresses were made by A. E. Barit, president of Hudson, Stuart G. Baits, first vice-president and assistant general manager, William R. Tracy, vice-president in charge of sales and George Pratt, sales manager. The complete technical program as well as parts, service and accessory merchandising for 1938 were covered.

URSCHEL AXLE MACHINE

IN ONE OPERATION

STRETCHES, HOT FORMS QUENCHES AND STRAIGHTENS



THIS WILL ELIMINATE COLD STRAIGHTENING

by limited contraction in predetermined alignment—even flow of quenching medium gives a uniform straight piece.

CUT COSTS

by eliminating extra hot forming operations and cold straightening.

IMPROVE THE PRODUCT

Uniform hardness, greater physical properties.

Other machines designed to process tubular axles—rear axle housings—axle shafts—cam shafts—torque rods—sway bar eliminators—fabricated tubing—steering arms—and other heat treated parts that must be held straight after quenching.

URSCHEL ENGINEERING CO.

Bowling Green, Ohio

Chevrolet Features "Tiptoe-matic" Clutch

(*Continued from page 595*)

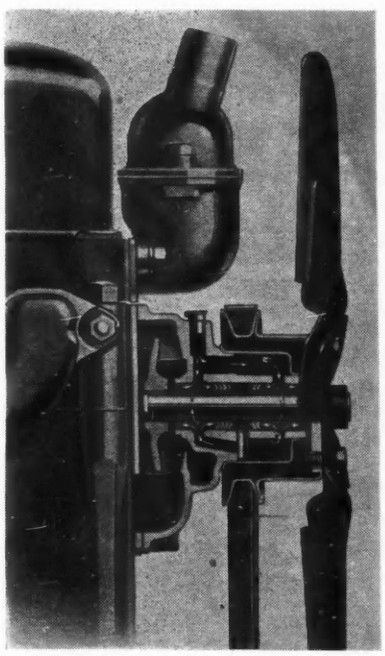
causes the rim of the spring diaphragm to move away from the clutch disk, and disengagement is accomplished. The spring is made of steel, heat treated and shot-blasted. When the clutch pedal is released, the "spring" in this material causes the fingers to pivot about the rear fulcrum ring and the rim to bear against the pressure plate.

There is said to be considerably less friction in the operating mechanism, bearing replaces the graphite bearing used last year.

By widening the rear tread from 57 9/16 to 59 in. the company has been enabled to increase the inside width of the body as well as the road stability of the car. In conjunction with changes in the design of the wheelhouse, the inside width at the rear seat has been increased 2 in. Corresponding changes have been made in the rear axle.

Rear springs are now completely insulated from the axle housings by rubber bushings and washers, used in conjunction with a bracket welded to the front of the housing on each side. Metal-to-metal contact is eliminated entirely, and this prevents "telegraphing" of road noises into the interior of the car.

Luggage-compartment space has been materially increased this year. The flat shelf under which the spare wheel rested horizontally has been removed, which gives 6⅞ in. greater height, and the compartment floor has been redesigned to include a well in



Fan and water pump assembly on 1938 Chevrolet.

for the diaphragm spring eliminates the three pressure levers and the nine clutch-release springs and their attaching parts. Moreover, the new clutch weighs 5 lb. less than the 1937 clutch. Including the flywheel, the weight is reduced 10 lb. It is claimed that the diaphragm spring assures a more nearly uniform distribution of pressure around the pressure plate, as compared with the three pressure levers of the 1937 clutch. The pressure plate and cover of the clutch have been redesigned to conform to the new spring. There is a crown near the rim of the pressure plate for contact with the spring, and three retracting springs keep the pressure plate and diaphragm in constant contact, thus preventing rattle. The clutch fork is now a forging instead of a steel stamping. A ball throw-out

GUARANTEED

Physical Soundness~Correct Hardness
Size Accuracy and Sphericity

A special lapping practice exclusive with Strom gives Strom Steel Balls a degree of surface smoothness and sphericity that has never been equalled in any other regular grade of ball. Extreme precision can be obtained only through such a series of lapping operations.

Strom Steel Balls are forged from solid bar stock. They are scientifically heat treated under automatic control and are hardened all the way through.

So it is that Strom can guarantee physical soundness, correct hardness, size accuracy, and sphericity in all Strom Balls.

Other types of balls—*stainless steel, monel, brass* and *bronze*—are also available in all standard sizes. Write for catalog, prices.

Strom STEEL BALL CO.
1850 So. 54th Avenue, Cicero, Ill.
The largest independent and exclusive Metal Ball Manufacturer

which the spare wheel rests in a nearly vertical position. The flat floor is covered with a rubber mat, while the top, sides and rear of the compartment are lined with insulating material. Tools are carried in a separate compartment just inside the rear edge of the trunk, and are reached by lifting out a wooden lid. The cover support is of a new, telescoping, automatic type.

Grays and tans predominate in the upholstery and trim. In the Master DeLuxe line, breathing-back mohair velvet is the standard and broadcloth an optional upholstery material, while in the Master series the former is the only choice. Interior improvements include a more attractive instrument panel, an illuminated ignition lock, "sure-grip" control knobs, a flush-type locking knob on the glove compartment, a steering wheel which can be adjusted to the spoke-position preferred by the individual driver, and a reversed control handle on the right-hand door of the coach and town sedan (to prevent accidental opening of the door when the seat is tilted forward).

Front-seat backs of all five-passenger models are softly cushioned on top, for safety in case of a sudden stop. Incidentally, the change makes for greater ease of ingress and egress in the case of four-door models. Resilient robe cords extend the full width of the seat-backs in four-door models of the Master DeLuxe series, and across the width of the individual seats in two-door models. Running-board mats with a heavily-ribbed surface are claimed to prevent slipping. Door sills have been redesigned to exclude weather and drafts.

The differences between the two series of Chevrolets remain practically the same as heretofore. In the chassis, the principal difference is the substitution of a conventional I-beam front axle, and semi-elliptic springs, on the Master, for the fully-enclosed "knee-action" units of the Master DeLuxe. Interiors are similar in appearance on both lines. Master DeLuxe models also have assist cords, a dome-light switch on the pillar post, ash receivers, rear-window curtains, and decorative door-sill plates. The instruments are the same, except for the addition of a water-temperature gage on the Master DeLuxe. In outward appearance both series are identical, except for the substitution of an embossed and painted running board edge for the stainless steel strip found on the Master DeLuxe, the addition of a name plate on the Master DeLuxe louvers, and the addition of bumper guards on the Master DeLuxe and Master Cabriolet. In the cabriolet Master model, and in all models of the Master DeLuxe series, there are arm-rests on the front doors.

Both lines include a coach, sedan, town sedan, sport sedan, and business coupe. The Master DeLuxe series also includes a Sport Coupe with rumble seat while the Master series includes a cabriolet, sedan delivery, and coupe pickup.

New Silver Dome Models

Silver Dome, Inc., Detroit, announces the introduction of five new trailer models for 1938, ranging in price from $435 to $895. All models are larger than before; all prices have been substantially reduced.

The coupler height has been set at 19 in. as recommended by the Society of Automotive Engineers. This new height also permits a more simple type of car hitch for easier installation than in previous years. The Bendix vacuum power brake system, is offered as optional equipment.

MEMA Index Slips

Grand index of the Motor and Equipment Manufacturers Association for August stood at 141 against 148 for July and 110 for August, 1936. The decline was due to a fall in original equipment shipments to manufacturers which stood at 140 against 153 for July, and 108 a year earlier. Service parts shipments to wholesalers went to 164 from 154 in July, against 147 last year. Accessories shipments to wholesalers stood at 118 against 116 and 75 respectively. Service equipment shipments to wholesalers went to 131 from 127, against 106 a year earlier.

Again Young radiators are called upon to meet unusual conditions of operation. The trucks and busses built by Kenworth Motor Company, Seattle, Washington, are designed to carry capacity loads over steep mountain trails, to operate in extreme altitudes and temperatures. The special radiators are designed by Young engineers to meet these varying conditions and furnish adequate cooling at all times.

Write for Descriptive Literature.

MANY EXCLUSIVE FEATURES

YOUNG RADIATOR COMPANY
RACINE, WISCONSIN
Young Quality

Refinements Stressed in 1938 Plymouth

(Continued from page 589)

device preventing the seat from getting stuck in any position. The control knob has been moved over to the left end of the seat, and into a higher, more convenient position. Front-seat cushions are of a new, graduated design that brings additional springs into play as the load increases. An anti-sag mat is built into the seat cushion all the way across.

A headlamp beam indicator on the light-control switch glows when the high beam is in use. For the convenience of back-seat passengers, ash receivers are built in at the ends of arm rests. The safety-styling features introduced last year are continued. Useful space in all luggage compartments and built-in trunks has been increased by removing the spare wheel from the floor, and mounting it flat against the inside panel. A new fabric lining dresses up the luggage space and affords added protection to baggage.

All controls are easier to operate this year. The clutch also has a new baffle plate to keep out oil and water vapor, a new and improved driven disk with two woven facings, and a new release-bearing spring, with increased grease capacity. Plymouth also has the "pistol-grip" type of handbrake control. Located up under the cowl and back of the instrument panel below the center of the board, this handle connects with a separate brake on the drive shaft, through a flexible cable. A pull of 15 lb. on the hand lever results in a brake pressure of 300 lb.

A 17-in. steering wheel is retained, but the steering-gear ratio is reduced from 16.4 to 14.6, and the pitman arm to 7 in. in length. This combination gives an over-all steering ratio of 17.6, which means 5 per cent faster steering than last year. Ordinarily this would make steering harder, but actually less steering effort is required with the new model, because the pivot axis of the front wheel now is outside the area of contact between tire and road, so the wheels are free to roll around instead of scuffing over to a new direction; and, besides, the upper end of the kingpin is now carried in a small roller bearing.

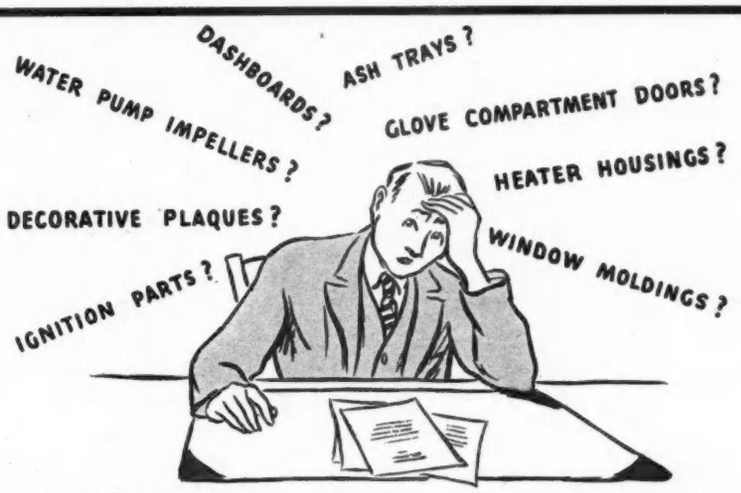
Headlamps of the new Plymouth have 8-in. lenses, instead of 7½-in., and the generator is of greater capacity, but 32-candle power bulbs are retained. The new generator, which has an improved ventilating fan, will deliver as much as 30 amperes, if called on to carry the load of headlights, heater, and radio all at the same time.

The 1938 Plymouth is claimed to be more quiet than the previous model, silencing research having been continued throughout the year. This year's improvements are due chiefly to the use of better sound-deadening materials throughout the car and a more rigid construction of the rear-floor panel, which made the whole job more quiet. Deeper ribs in the floor pan and a change in shape to make it fit more snugly underneath the front seat made this unit more rigid.

Trailer Body Expands

A preview of the 1938 Covered Wagon, passenger trailers, was given representatives of the press Oct. 12 at the Covered Wagon Co.'s plant in Mt. Clemens, Mich. The new line will comprise three body lengths, priced only slightly higher than the 1937 models.

At a luncheon following the preview, James L. Brown, vice-president in charge of sales, disclosed that the association of trailer manufacturers has been reorganized and will move its headquarters from Peoria, Ill. to Detroit with offices at 3303 Eaton Tower Bldg. A full time manager will be placed in charge of the office and the association plans to make its influence felt in legislation and other matters affecting the interests of the trailer industry. It is to be a very active trade association, Brown indicated.



Planning Plastic Parts?

No matter what the problem when you're planning new plastic parts, try Durez first. Whether you're seeking heat, chemical or electrical resistance . . . whether you want new beauty in appearance or more convenience in handling, call on General Plastics Inc., the largest suppliers of plastics to the automotive industry.

With Durez you gain unlimited design possibilities. You get lustrous color, a smooth pleasant-to-touch surface finish that never shows signs of wear . . . looks "new" always. You add parts whose appearance speaks "quality", whose costs speak "economy".

Whether you're planning a brand new use or a variation on an older one why not find out more about Durez? For complete information, write General Plastics Inc., 210 Walck Road, North Tonawanda, New York.

General Plastics'

DUREZ *Choice of the Automotive Industry*

New Cadillac Line for 1938

(Continued from page 592)

The same transmission now is used throughout, the only difference between LaSalle and Cadillac transmissions being in the length of mainshaft and extension. The countershaft diameter has been increased to 1 in. The width of the second-speed countershaft gear has been increased by ⅛ in., and other detail changes have been made. Synchronizer drums are 1/16 in. narrower than before, to increase their unit pressure and improve synchronizer effectiveness. They have been lightened and strengthened by the use of a new corrosion-resisting aluminum alloy.

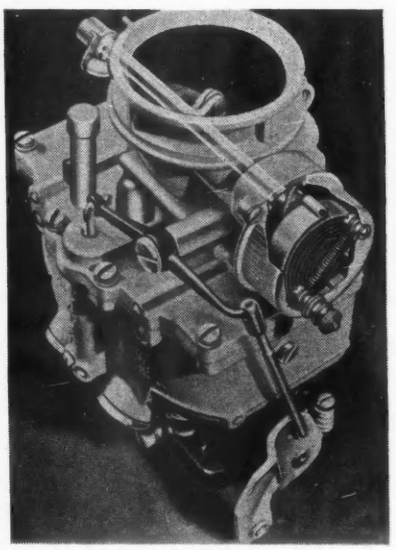
Shift rails have been eliminated in favor of rotating shafts and levers. A special "mountain" transmission is standard for the 75 commercial chassis, and optional on 50 and 65 commercial jobs.

Series 60 frame differs from the frames of other models dimensionally. It is of double-drop construction and is 3-in. lower. Frames for other models have been increased in stiffness, that of the 90 being 100 per cent stiffer torsionally. The LaSalle frame remains unchanged.

A new hypoid axle is used for the series 65, 75, and 90 cars, while the former axle is continued on the LaSalle and 60 with some modifications. Two mechanical changes characterize the larger axle, namely, threaded-sleeve adjustment for the differential side bearings, and the use of tapered-roller bearings on the pinion, separated by a sleeve, pre-loaded at assembly and shim-adjustable. The ring gear diameter is 11 in.

In the smaller axle, Timken bearings are used on the pinion shaft, preloaded with shim adjustment. The spiral angles of all hypoid gears has been increased from 45 to 50 deg.

Series 60 and 65 rear treads have been increased. The rear-axle ratio has been changed on all models except the LaSalle. Propeller shafts are shorter, despite the longer wheelbases, with universal-joint flange surfaces ground at assembly for more accurate balance. Five different shaft lengths are required for the line.



The Stromberg carburetor used on the new models. A vacuum-operated economizer has replaced the former throttle-operated economizer

Exhaust pipes are different, with transverse-mounted mufflers. A separate expansion chamber is placed in the exhaust pipe ahead of the muffler on all Cadillac models, eliminating the former exhaust "spreader." The La-

YOU Must CONSIDER
TODAY'S TRENDS!
The correct oil film to each individual bearing... automatically
"Pratt & Whitney" Lathe
BIJUR
AUTOMATICALLY Correct LUBRICATION
● The Bijur Automatic Lubricating System is standard equipment on the most advanced machine types. Speeds stepped up . . . wider feed ranges . . . greater accuracy! Such machines MUST show low-cost operation per unit of output. This necessitates MAINTAINED accuracy . . . low maintenance expense. All assured by BIJUR lubrication—for sliding way surfaces as well as bearings! Investigate the wide range of Bijur use on up-to-date machines. Its economy, too. Write for Bulletin "D" on modern lubrication progress.
BIJUR LUBRICATING CORPORATION • LONG ISLAND CITY, NEW YORK
916

Salle muffler is placed longitudinally near the center of the frame, as before.

Steering systems are continued with minor changes. Cadillacs have cross-type steering on the 50 and 60, and longitudinal drag links on the 65, 70 and 90. Steering-column universal joints are continued on the 75 and 90.

The cross-link type rear stabilizer adopted on LaSalle last year is now standard on all models. All models continue end-to-end discharge shock absorbers. LaSalle front suspension has been improved by the addition of threaded bushings at the inner ends of the lower control arms. Oil seals of synthetic rubber are used on the lower control arms.

Instrument panels are new and have a molded-plastic center section.

All control knobs are of colored plastic and are set in a recess for safety.

Chassis wiring harness has been changed to facilitate service operations and now includes radio and heater connections. It passes through a larger grommet in the dash and may be pushed through from either side. Batteries are mounted under the hood on all models except the V-Sixteen, and are of the same construction and dimensions as before. An automatic battery filler is available as an accessory.

LaSalle bodies remain the same, but exterior eye-appeal has been enhanced by new sheet metal and radiator grille. Cadillac bodies are all-steel and new throughout.

The Cadillac 60 differs radically from all other lines. It has no running boards and is sufficiently low to permit entrance directly from the curb. To make the low mounting possible and to improve the vision, several departures from conventional body design were necessary. One of these consists in hinging the wide doors at their fronts; that is to say, the front doors are hinged below the windshield pillar and the rear doors to the centerpost. All hinges are below the belt line, and the door frames proper do not extend above the window line, only the window glasses, which slide in narrow, chromium-plated frames, projecting above this line. This is similar to designs which have been used on convertible bodies in the past and permits a considerable reduction in the width of pillars, thus improving the vision.

From the rear the unusual amount of "tumblehome" is apparent. The curved sides of the series 60 body add to its ground-hugging appearance. The gracefully streamlined tail, which suggests racing speed, conceals a large luggage compartment. The windshield and windows are higher relative to the seat cushions, which increases the angles of vision upwardly. This effect is obtained by carrying the windshield glass almost to the top of the body. Corner radii of windshield and window glasses have been reduced, also with the object of increasing the field of vision. The pillars themselves are narrower. The windshield-pillar width has been reduced by 1 in., to 2¾ in. and, even considering the additional obstruction of the front-door frame and ventipane frame, the total width of the left-hand pillar from the angle of the driver's eyes is only 3 in.

Fleetwood bodies for 1938 are wider and longer. One notable interior improvement is in the auxiliary seat construction of seven-passenger sedans and imperials. A new design reduces the thickness of front-seat back required, which adds to tonneau length and increases the effective width of the rear door. The auxiliary seats now fold flush into a depression in the seat back, giving a neat paneled appearance and avoiding annoyance, as well as unsightly zipper flaps or latched covers. The seats are raised by merely pulling back on strap handles on what appears to be two panels in the front-seat back.

NAT SAYS...

The rough and manly sports are for
Us fellows who are tough;
And when you yell, "Nat, make a score!"
I'll do it, sure enough.

National PRODUCTS

Nuts and Bolts
Machine Screws
Cap and Set Screws
Wood Screws
Cotter Pins
Spokes and Nipples
Stove Bolts
Wing Nuts
Pipe Plugs
Rivets, Tacks

THE NATIONAL SCREW & MANUFACTURING CO.
CLEVELAND • OHIO

New Clutch for Chevrolet Trucks

(Continued from page 593)

jaw for the rubber around the frame plate. It places the rubber under compression and thereby counteracts the forces which tend to separate the rubber from the frame plate. The frame plate is thicker and, in general, the engine rear-mounting assembly is stronger and more durable.

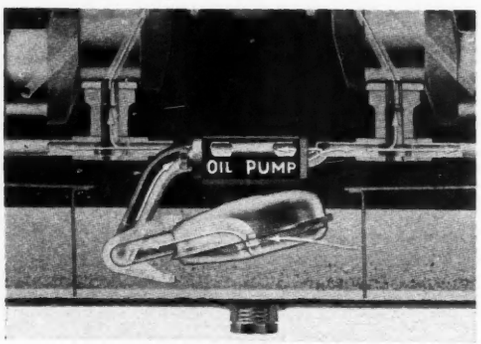
A new method of bolting the engine rear-mounting brackets to the clutch housing is incorporated in the one-ton and one-half-ton trucks. Bolts with smooth, dowel-like shanks are used, and serve virtually as dowels. There are no threads within the hole in the bracket, and the resistance to shear is materially increased. These bolts are secured by lock washers. The half-ton, three-quarter-ton, and one-ton truck engine rear mountings for 1938 also are doweled to the clutch housing by means of the piloted attaching bolts.

Steering wheels of all trucks now have serrated joints (36 serrations) with the steering shaft, instead of being fastened thereto by a single Woodruff key. Also, by replacing one of the bolts in the steering-gear housing with a drilled bolt, the housing is vented, which eliminates the possibility of pressure building up inside of the housing and forcing out the grease. A stand pipe inside the steering column serves to maintain the proper grease level in the housing.

The hand brake in the half-ton, three-quarter-ton and one-ton trucks has been redesigned for longer life, firmer engagement, and easier release. There are now ten instead of eight sector teeth, and two pawl teeth instead of one, the sector teeth being smaller and more closely spaced. With the added tooth in the pawl, tooth life is increased. Finer teeth in the sector permit tooth engagement with less lever travel. Moreover, the tooth angle relative to a radial from the pawl fulcrum is such as to assure an easier release and better tooth engagement.

An 18-gallon fuel tank, used on all 1938 cab trucks and the one-and-a-half ton single-unit body trucks, is mounted under the driver's seat. A riser formed across the top half of one end of the tank prevents air from being trapped by fuel entering the tank from the filler neck, which has made possible the elimination of breather tubes. On all cab-type trucks the filler neck emerges from the end of the riser, while on the one-and-a-half-ton single-unit-body trucks, the filler neck projects from the side of the riser. In both cases, the filler neck extends outside the body. Where it passes through the body panel, a molded-rubber grommet seals the clearance hole and prevents spilled gasoline from entering the cab or body. With the filler neck attached to the riser—the highest point of the tank—rapid filling of the tank is possible without fuel being blown out again by trapped air. On the half-ton, three-quarter-ton and one-ton single unit body types, the fuel tank remains the same as last year and is mounted contiguous to the frame side rail. With this type, too, the filler neck extends outside the body and is provided with a molder-rubber sealing grommet.

In all fuel-tank installations, a flexible coupling of synthetic rubber is used on the filler necks to relieve the soldered joint of the filler neck to the tank of stresses. The fuel gage on all truck tanks is also improved. A flat lead contact spring, replacing the plunger-type contact, eliminates the possibility of sticking, and its increased contact area promises longer life. A non-flooding, ventilated filler neck cap is used on all trucks.



The following outstanding manufacturers use FLOAT-O

Allis-Chalmers	Int'l Harv. Co.
Auburn	Lycoming Motors
Buda	Morse Motors, Ltd.
Buick	Otto Engine
Cadillac	Pierce-Arrow
General Motors Corp. Diesel Engine Division	Studebaker
	White Motors
	Willys-Overland
General Motors Truck and Coach	Wolseley Motors Ltd.

Other prominent builders definitely committed for 1938 models.

FLOAT-O Engineers are ready to consult with you.

From the Lowest to the Highest Priced Cars in the World Use

FLOAT-O

BECAUSE IT

Supplies bearings with the "Cream" of the Oil—from the top of the Crank Case

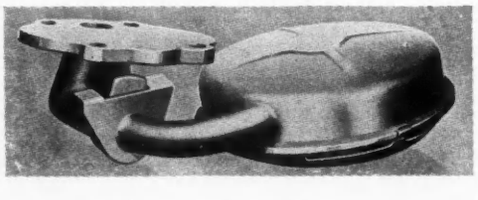
The sludge, filings, and heavy abrasives which cause serious engine wear and inefficiency naturally precipitate to the bottom of the crank case. FLOAT-O installed at the pump intake, draws horizontally from the clean oil found at the top—it does not disturb the harmful substances found at the bottom of the crank case. With FLOAT-O only this "cream" of the oil sump is distributed to the bearings. This is true during starting and all running conditions. FLOAT-O is also a definite guarantee against ice locking.

Indorsed and approved by the leading research engineers of the industry, FLOAT-O insures quicker starting, smoother operation, and longer life for engines.

Write for Literature

TAYLOR SALES ENGINEERING CO.

ELKHART INDIANA



Two Graham Lines Fitted to '38 Modes

(Continued from page 583)

cessive strains on the cylinder block when the manifold is expanded at high operating temperatures.

The engine pan is made in two sections, and the upper section is carried up to the level of the bottom of the cylinder water jacket, so that it serves as a baffle between the exhaust pipes and the engine block. This places the fuel pump outside the pan, where it is exposed to a cooler atmosphere, so that it is effectively protected against vapor lock.

A Long 9½-in. semi-centrifugal clutch is standard on both models. The new Spicer hypoid axle has the same ratio as was used last year, viz., 4.27, but an option is given on a special ratio of 4.55.

A Willard battery of 105 amp-hrs. capacity is standard equipment, but for radio installation a battery of 120 amp-hrs. is furnished. The battery is mounted under the hood and fitted with a special bottle expansion chamber for each cell, to take care of expansion of the electrolyte in the warm atmosphere under the hood.

Mounting very wide and long bodies, Graham has endeavored to provide a more rigid connection between body and frame. The chassis frame has been made 2 in. lower through its center section, and is heavily reinforced at the X-member by the introduction of a deep center member crossing through the center of the X-member and tying into the side rails. Outrigger body mountings are used and are attached to the side rails at points which are specially braced. The front end, over the front cross-member, is a special braced structure which houses the radiator core and serves to tie the cowl framing directly into the frame, as illustrated.

Bodies are of all-steel construction, with steel top, wider and roomier than in the past. Both front and rear seats have a clear width of 57 in. Body hardware is new, and includes very neat safety handles that curve directly into the door panel. Special ball-and-socket concealed hinges are used on all doors. These concealed hinges simplify the operation of door hanging, as the special construction takes care of alignment in every direction.

A handsome instrument panel with instruments grouped at the extreme left makes for an interesting interior. The instrument panel features sections of molded plastic and has control knobs in molded plastic set into a recess at the center for safety.

Two special defroster outlets mounted on top of the instrument panel replace the single defroster outlet used last year.

Direct-acting shock absorbers mounted inside the side rails are continued. A front sway bar is standard. Hydraulic brakes are continued.

Diesel Fuel Specifications

A new British standard specification for fuels for automotive Diesel engines has just been issued. It parallels to a considerable extent the former specifications for fuel oil. What was formerly known as the "cold test" has been replaced by the "pour point." In addition, the specifications require the determination of the Conradson carbon content, sulfur content and aniline point, as well as the distillation percentage by volume at 350 deg. C. A series of appendices detail the methods by which the tests are to be conducted, which are those laid down by the Institution of Petroleum Technologists in the 1936 edition of Standard Methods of Testing Petroleum and its Products, published by the Institution at its offices, Aldine House, Bedford Street, London W.C.2.

Forgings with a background—

Behind every Wyman-Gordon forging stands diligent scientific examination of every bar of steel—continuous laboratory control of all processes.

WYMAN-GORDON

Worcester, Mass. Harvey, Ill. Detroit, Mich.

HEART of the Miniature Automobile Show recently held at Rockefeller Center, New York. This was the central display and contained a number of miniature car exhibits against geographical or futuristic backgrounds. The exhibits included Soap Box Derby cars, pedal-powered toy cars, scale models of automobiles and the miniature car models.

UAW Speeds GM Talks

(Continued from page 534)

cedure now in effect for this condition.

Investigation of the present unrest among GM workers, according to the union, revealed that the chief complaints were: 1—Question of speed of production; and 2—Inadequate manpower and a tendency on the part of the management of certain plants to "cut corners" rather than to carry out the full spirit and intent of the UAW-GM agreement.

Considerable emphasis was placed by the various chairmen on the problem of decentralization of operations. In many cases, particularly Cleveland, Toledo, Lansing and others, the question has become very acute, the UAW declared, charging that this policy has forced many workers to go from the payroll to the relief roll.

Only through the establishment of corporation-wide seniority in which the worker would accompany the job can this problem be eliminated it was claimed. Equal pay for equal work throughout all GM plants was declared to be a basic necessity, and the committee advocated setting up of a uniform scale of wages in all GM plants, regardless of geographical location.

The committee expressed unqualified approval of the resolution recently adopted by the CIO in Atlantic City relative to the keeping of contracts with employers but insisted that its disavowal of unauthorized action should not be interpreted by automobile manufacturers as an unwillingness to engage in authorized strike action when it was for the purpose of protecting or advancing the welfare of members.

The conference supported President Martin's statement to the delegates that the committee press forward to a quick consummation of the revisions of the agreement and, should the corporation be unwilling to grant concessions demanded, that the local unions further solidify their ranks to be prepared to take action in the event a satisfactory understanding is not reached. It was stated, however, that "the UAW does not wish to convey the impression that there will be a strike in GM."

Several strike votes, however, have been taken in GM plants which union leaders say were for the purpose of sounding out sentiment of the workers but which other observers regard as efforts to bring pressure on the corporation in the current negotiations. Such a vote is being taken this week at the Milwaukee Ave. plant of Fisher Body in Detroit where recently an unauthorized strike occurred.

PRECISION PAYS

6 WEEKS FROM NOW I COULD TELL YOU WHICH IS WHICH

DANLY DIE SETS AND DIE MAKERS' SUPPLIES
from the
8 Danly Branch Stocks

BRANCHES:

LONG ISLAND CITY, N. Y.
36-12 34th STREET
DETROIT, MICHIGAN
1549 TEMPLE AVENUE
CLEVELAND, OHIO
1745 ROCKWELL AVENUE
DAYTON, OHIO
990 E. MONUMENT AVENUE
PHILADELPHIA, PA.
3913 N. BROAD STREET
ROCHESTER, N. Y.
16 COMMERCIAL STREET
MILWAUKEE, WIS.
513 EAST BUFFALO STREET

● Die Sets look alike because accuracy to ±1/10,000 of an inch is not visible to the naked eye. But in performance there's a vast difference.

Danly Precision Die Sets have the absolute close tolerance of fit between guide posts and bushings that means freedom from shearing, more accurate and faster production, fewer regrinds and longer life for the die.

Precision Pays—secure it by specifying Danly Precision Die Sets for your dies.

DANLY MACHINE SPECIALTIES, Inc., 2118 So. 52nd Ave., Chicago, Ill.

DANLY PRECISION DIE SETS

Automotive Metal Markets

Volume of Buying Rises as Automobile Manufacturers Need More Steel for Near-Future Assemblies

Progressive improvement in the aggregate volume of steel buying by automotive consumers continues to be recorded. Not only is this gain in sharp contrast with the utter absence of demand from most other steel consuming lines of manufacturing, but it is all the more noteworthy as there is no deviation from strictest adherence to the policy of restricting tonnages to requirements for nearby assemblies.

Announcement by the leading steel producing interest that first quarter prices would remain unchanged from those now prevailing was interpreted in the steel market not so much as a bid at this time for 1938 business as a wish to buck up the morale of smaller producers who, in their eagerness for orders, might be tempted to make price concessions. Coming at least a month ahead of the usual time for such announcements, the leading producer's notice preceded by a few days this week's slump in commodity and security prices, which turned all sellers' into buyers' markets overnight. From no authoritative quarter was any definite appraisal of the effect on the steel market of these developments forthcoming. What Congress may or may not do during the special session is another unknown quantity that may more or less directly affect steel prices.

Finishing Mills' Position

On the basis of this week's estimate of 58.8 per cent of ingot capacity operations, the picture of the steel industry looks far more depressing than it actually is. Finishing mills, with extensive reserves of primary steel on hand, are operating at a considerably higher rate than the week's ratio of ingot output to theoretical capacity. This is especially true of those finishing mills that depend largely for support upon orders from automobile manufacturers and parts makers. Especially are the smaller finishing mills getting fair-sized orders from one of the large automobile manufacturers whose policy it is to distribute business over as large a number of the smaller steel-makers as possible.

Pig-iron producers are accumulating stocks in anticipation of quickened demand from automotive foundries in November and December. Reaffirmation of going steel prices for first quarter 1938 shipments in the steel market is accepted in the pig-iron market as a signal for like action, but further developments are being awaited before formal announcements are made.

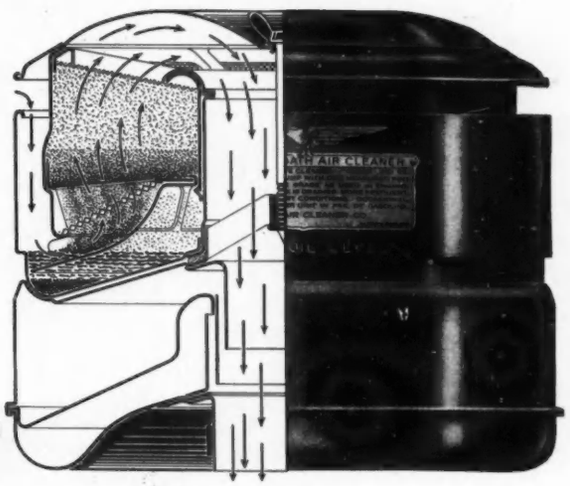
The non-ferrous metal markets were completely under the influence of Wall Street happenings this week. Early this week some copper was sold at as low as 11¾ cents, but when the stock market staged a rally, no offerings at below 12 cents could be uncovered. Some producers continue to quote 13 cents, but their sales are confined to transactions with their subsidiary fabricators.

A month ago Straits tin sold only a fraction under 60 cents. At the beginning of this week spot deliveries could be had at 50¼ cents with November delivery quoted at 49⅞ cents, and on Tuesday the spot price was down to 48 cents. As usual under conditions when prices fluctuate sharply, consumers held to the side-lines, waiting for steadiness to develop.

Lead was quoted at the beginning of the week at 5½ cents, New York, a new low for the year and $45 a ton lower than the year's high. While the metal's statistical position is sound, sharp dips in London caused apathy on the part of consumers and the markdown was resorted to in order to revive consuming interest in the market. Zinc is selling $5 a ton below the levels of a week ago. —W. C. H.

HIGHEST AIR CLEANING EFFICIENCY

UNITED
GUARANTEED PRODUCTS.



Cut-away view of United Oil Bath air cleaner and silencer.

WHAT CUSTOMERS ARE SAYING

Customers tell us that we build the most substantial oil bath air cleaners available for car and truck installations. Furthermore, these cleaners are noted for highest cleaning efficiency at wide range of throttle openings or variable horsepower loads.

It is these same high-grade, high cleaning efficiency oil bath air cleaners which are built into United combination silencers and cleaners—combinations which are unexcelled for silencing qualities. United combinations are standard equipment on nationally known cars.

PROVED MERITS, CONSTRUCTION AND PERFORMANCE, MAKE *UNITED* PREFERABLE TO MANY LEADING CAR, TRUCK AND FARM TRACTOR MANUFACTURERS.

UNITED AIR CLEANER CO.
Division of United Specialties Company
9705 COTTAGE GROVE AVE. CHICAGO, ILL.

Business in Brief

Written by the Guaranty Trust Co., New York

Business Level Drops

General business activity during the week ended October 9 declined sharply, mostly as a result of curtailed steel operations and a drop in car loadings and lumber production. The weekly index compiled by the "Journal of Commerce" stood at 100.3, as compared with 103.1 the week before and 100.6 a year ago. Retail trade during the week ranged from 2 to 8 per cent above that in the preceding week and from 4 to 16 per cent above that a year ago. Some authorities anticipate the heaviest holiday buying of recent years.

Railway freight loadings during the week ended October 9 totaled 815,122 cars, which marks a decline of 32,123 cars below those in the preceding week, a decrease of 5448 cars below those a year ago, but a rise of 80,968 cars above those two years ago.

Production of electricity by the electric light and power industry in the United States during the week ended October 9 was 5.1 per cent above that in the corresponding period last year.

Store Sales Up

According to the Board of Governors of the Federal Reserve System, department store sales in September increased by more than the usual seasonal amount. The board's adjusted index for that month stood at 95, as compared with 92 the month before and 88 a year ago.

Construction contracts awarded in September in 37 eastern states, according to the F. W. Dodge Corp., amounted to $207,071,800, which marks a decline of 28 per cent below the August level and of 10 per cent below that a year ago. For the first nine months of this year contract awards were 13 per cent above those in the corresponding period last year.

Farm Prices Off

According to the Bureau of Agricultural Economics, prices of farm commodities at the middle of September were the lowest in 14 months. The index stood at 118, as compared with 123 a month earlier and 124 a year ago.

Professor Fisher's index of wholesale commodity prices for the week ended October 16 stood at 89.5, as compared with 89.8 the week before and 90.7 two weeks before.

The consolidated statement of the Federal Reserve banks for the week ended October 13 showed no changes in holdings of discounted bills, bills bought in the open market, and Government securities. Money in circulation increased $16,000,000, and the monetary gold stock rose $19,000,000.

Buys Cord Corp. Stock

R. S. Pruitt, officer and director of the Cord Corp., on Aug. 6 acquired 40,000 shares of Cord stock, making his holdings at the end of the month 67,834 shares, according to a Securities and Exchange Commission report.

Company Earnings

Caterpillar Tractor

The Caterpillar Tractor Co. reported net income for the first nine months of the year of $9,135,935 against net income of $7,032,469 for the first nine months of 1936. Net sales for the latter period were $54,405,599 compared with $42,125,197 in 1936. Per common share earnings comparison is not made because of the issuance at the end of 1936 of preferred stock.

Buda

The Buda Co. reported for the year ended July 31 net income of $354,877 or $1.93 per share. No comparison is available.

E. G. Budd

The Edward G. Budd Mfg. Co. reported net income for the third quarter of $107,465 after all charges but Federal surtax. This compared with a net loss of $547,400 for the like period of last year. For nine months the net income was $1,198,329 or 53 cents per common share after provision for preferred dividends, against an operating profit of $138,434 for the like period last year. The company stated that the third quarter gain was traced to increased railroad equipment business in the face of smaller automobile body business upon model changes.

Budd Wheel

The Budd Wheel Co. reported net income of $75,055 for the third quarter, against $140,035 for the like portion of 1936. For nine months the net income was $596,015 or 58 cents per common share, against $658,728 or 64 cents per share for the 1936 period.

New Clark Office

The Clark Controller Co. has moved its Detroit office to 710 Fisher Building. Coincident with this move to larger space, Arthur B. Sonneborn, manager of the Detroit office, with two new men, John Kilpatrick and George B. Martin, will also represent Federal Welder interests.

New Mechanics Slip Joint Reduces Vibration

The new Mechanics Slip Joint reduces vibration to a minimum by securing a more perfect alignment of parts and effecting a major reduction in weight through an ingenious but simple change in design and construction. The large diameter slip yoke now has external splines. The slip sleeve, with accurately machined internal splines, is a press fit in the tube and welded in place. Both yoke and sleeve are aligned on the cylindrically-ground portion of the slip yoke so that the accuracy of the assembly is independent of the fit on the sides of the splines. Increasing the number of splines on the larger circumference substantially reduces unit pressures—total weight is reduced about 2 pounds—thrust loads are reduced—long life is assured through improved lubrication. Write for information.

MECHANICS UNIVERSAL JOINT DIVISION
Borg-Warner Corp. 1301 18th AVE., ROCKFORD, ILLINOIS

AUTOMOTIVE ABSTRACTS

"Visibility" Standardized

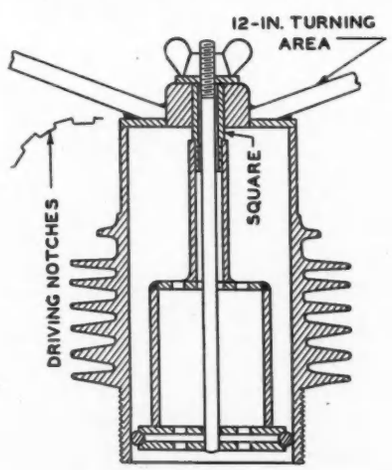
There is no doubt that the blind spot caused by windshield pillars has been an important factor in accident causation in the past, and it has been pointed out that in some cases the width of the pillar is sufficient to blot out a mounted policeman at short range.

Discussions have been proceeding between the Minister of Transport and the Society of Motor Manufacturers and Traders regarding the minimum standard of driver's visibility, and these have now been brought to a satisfactory conclusion. In consequence thereof, the Institution of Automobile Engineers, in cooperation with the Society of Motor Manufacturers and Traders, has issued a standards leaflet on "Visibility from the Driver's Seat of a Motor Vehicle." On this leaflet a geometric construction is given for determining whether the desired degree of visibility is attained in any particular lay-out. The permissible width of the blind spot due to a pillar is 2 ft. at a radius of 20 ft. from the driver's seat, if the pillar is so placed on the driving side as to permit of a clear angle of vision of 35 deg. on that side, measured from a line through the center of the seat parallel with the axis of the car and 2 ft. 6 in. if the clear angle of vision exceeds 35 degs. For a pillar in any other position the permissible width of the blind spot is given as 2 ft. at the same radius.—*Engineering*, Sept. 24.

Making Shrink Fits by Cooling in Liquid Nitrogen

When one part is to be made a shrink fit in another, such as a valve-seat insert in a cylinder head or cylinder block, it can be readily put in place after first cooling it in either liquid nitrogen, which has a temperature of minus 320 deg. F., or in dry ice (minus 112 deg. F.). This process is of special advantage if the part to be shrunk in position is relatively small, as the large mass remains at room temperature. In the case of an aluminum casting this has the further advantage that the difficulties resulting from its exposure to high temperatures are avoided.

This process calls for only very simple equipment, including a special receptacle for cooling the parts, and suitable mountings, but the necessity of having a supply of liquid nitrogen permits of its application only close to the centers of production of the liquid. Special precautions must be taken so the operator's hands will not come in contact with the liquid nitrogen nor with the parts that have been cooled by it. The operator must wear asbestos gloves or protect himself in some other suitable way.



The drawing reproduced herewith shows a fixture for applying aluminum cylinder heads of radial aircraft engines to their steel cylinders. The cylinder head is heated to a temperature of 350 deg. F. in an oil bath, while the steel cylinder, which is screwed into the head, is cooled in liquid nitrogen to minus 320 deg. F. A small amount of the cold liquid remains inside of the cylinder while it is being screwed into the head, so that this operation need not be hurried.

Theoretically it takes 0.12 quart of liquid nitrogen to cool one pound of copper, 0.14 quart for a pound of bronze, 0.155 quart per pound of brass, 0.216 quart per pound of cast iron, 0.24 quart per pound of steel, and 0.255 quart per pound of aluminum. A certain proportion must be added for loss during transportation, transfer and evaporation. This method is being used on a considerable scale for the insertion of valve-seat inserts. In the case of inserts with smooth outer surface this method is usually combined with a mechanical one, the fixture being given a light hammer blow.—*Revue de l'Aluminium* for July and August.

(*See next page, please*)

4 Big Reasons for Using DELTA DRILL PRESSES

A battery of twelve 17-inch Delta drills saving money for a Detroit auto-accessory manufacturer.

1 ● They are low in first cost.

2 ● They are extremely economical to maintain and operate.

3 ● They are highly adaptable, and engineered for long life.

4 ● They will continue to save you money throughout their entire life.

BECAUSE Delta drills are built to precision standards in a modern production plant, they cost you less than any comparable drills you can buy.

Because they are equipped with self-sealed ball bearings throughout, they require no lubrication at any time—and practically no other maintenance.

Because they are thoroughly engineered and tested under production, they will "stand up and take it" alongside drills costing several times more.

Because of their low cost, low maintenance and low power consumption, they can be used in dozens of places in your plant where heavy, expensive machines would be out of the question.

Let us tell you the complete story of Delta Drill Presses, 11", 14" and 17" models. Write—NOW—for complete information and name of nearest dealer. It will pay you dividends.

DELTA MFG. CO.

612 E. Vienna Ave., Milwaukee, Wis.

Effect of Cylinder-Bore Condition on Corrodibility

By means of electron-diffraction methods Prof. G. I. Finch has shown that the surface of a freshly-honed, unused cylinder liner is crystalline in structure but that after the aircraft engine to which it is fitted has been run in, the liner gives an entirely different diffraction pattern, indicating amorphous metal as usually associated with the Beilby layer (see *Science Progress* for April, 1937). By the same methods Professor Finch has further shown that if the surface of cast iron, of the quality usually used for piston rings, is gently rubbed with fine emery paper, it does not exhibit the crystalline structure of iron, but that of graphite. The record produced indicates that the graphite crystals cover the iron completely, and that they are all orientated, so that the basal planes of the graphite crystals are parallel to the metal surface; that is, the hexagonal plates of graphite are laid on tile-wise. Finch obtained this pattern also from the graphoid surface produced on a bearing in which a graphite lubricant had been used.

To determine the relative resistances to corrosion of surfaces with amorphous and crystalline structure respectively, Dr. A. H. Stuart cut a number of short specimens from a ⅜-in. rod of mild steel and trued one end. These specimens were placed in contact with aerated water that served as an electrolyte. Under these conditions some iron atoms pass into the water and become ionized, and a state of electrical equilibrium between the positively-charged ions and the negatively-charged metal surface is reached when the ionization of atoms is balanced by the oxidation of ions. Hence the potential of the iron is an index of the rate of oxidation, that is, of corrosion.

Records of the electrical potential of the specimens over a considerable period were obtained, and in each case, after some variation during the early period, the potential reached a stable value. With a mild-steel rod in filtered rain water the negative potential became stable at about 0.675 volt after 50 hours. With a similar specimen of which the surface had been polished by long rubbing on nearly smooth emery paper, the negative potential became stable at about 0.692 volt after 50 hours. The electrical potential being somewhat greater, the natural implication is that the rate of oxidation (corrosion) is greater. The third specimen, which had been "run in" with colloidal graphite, gave a potential-time record which became stable at 0.640 volt. From these results Professor Stuart concludes that a surface produced by a high-speed grinder or hone, becomes more anodic, or more prone to corrosion, by being polished by any rubbing process akin to the conventional running-in process, provided it is carried out dry or with plain oil as a lubricant; but that if colloidal graphite is incorporated with the lubricant, or is used as the sole lubricant while suspended in a medium such as water, a surface is produced which is definitely less anodic than that produced by the ordinary finishing processes, and therefore, less subject to corrosion.—*The Automobile Engineer* for September.

THE *Standard* THERMOSTAT

Insure correct engine temperatures as America's leading manufacturers do . . . with Sylphon Thermostats. They will aid your efforts toward greater fuel economy and increased engine efficiency. Quality thermostats . . . originated by Sylphon . . . built by Sylphon . . . to function positively and dependably for the life of the engine for which they are designed.

Sylphon engineers will be glad to consult with you.

FULTON SYLPHON COMPANY, KNOXVILLE, TENN.

Niagara Machine & Tool Works has issued a new bulletin, No. 60-C, describing improvements and developments in the complete line of **horn presses.** The bulletin is fully illustrated.*

A new **general catalog,** No. 58, has been issued by Gits Bros. Mfg. Co., Chicago, manufacturers of oil seals, oil cups, grease cups and automatic and centralized lubricating devices.*

First issue of *Arc Welding Foundation News* has been published by The James F. Lincoln Arc Welding Foundation.*

The 1937 survey of industrial **advertising budgets** issued annually by the National Industrial Advertisers Association has just been distributed to members. It is a 12-page leaflet of tables.

A new booklet on the **prevention of welding and cutting fires** has been published by the Linde Air Products Co., division of Union Carbide & Carbon Corp.*

October issue of the *Amsco Bulletin,* publication of the American Manganese Steel division of the American Brake Shoe & Foundry Co., contains a number of items showing the **application of the product.***

A 30-page industrial handbook on the uses of **industrial tires** for materials handling equipment has been issued by the B. F. Goodrich Co.*

The September-October issue of *Oakite News Service* contains an article on the improvement of factory conditions by **elimination of odors.***

A **folder** on "Building Your Own Simplified Arc Welder" has been issued by the Hobart Brothers Co., Troy, Ohio.*

* Obtainable from editorial department, AUTOMOTIVE INDUSTRIES. Address Chestnut and 56th Sts., Philadelphia.

TOOLS OF TOMORROW

Milling

. . . light design of knee and column type added to Producto line.

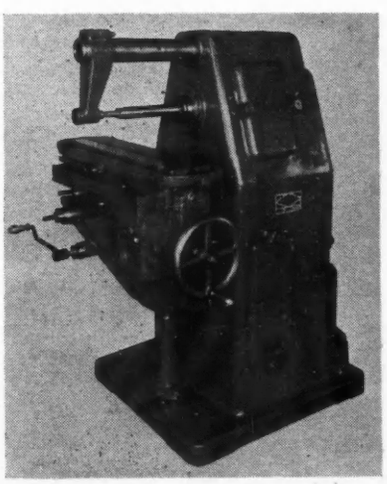
A light design of knee and column type of milling machine with power feed of the table was recently added to the line of equipment manufactured by The Producto Machine Co., Bridgeport, Conn. Twelve changes of spindle speeds and six changes of table feeds are provided by V pulleys and belts. All pulleys and shafts in the transmission rotate on anti-friction bearings and are continually in a bath of lubricant.

The cutter spindle is made of alloy steel hardened and ground all over, and rotates on two Timken roller bearings constantly lubricated. It has a No. 40 National Standard Taper on the end.

The table feed mechanism consists of a telescopic universal drive shaft from the transmission into the gear box, mounted on the underside of the saddle. Feed of the table is through a steel screw and bronze nut. Adjustable dogs are mounted on the side of the table to trip the automatic longitudinal feed of the table.

This machine accommodates standard attachments and tools, such as a vertical milling attachment, five-inch swivel vise, six-inch universal index centers, end mill adaptors, standard cutter arbors, etc.

Some of the essential specifications of the No. 14 plain knee type miller include: longitudinal power feed table, 14 in. (16 in. obtainable); cross feed of table, 7 in.; vertical feed of table, 12 in.; distance of face of spindle to center of table, min., 4 in., max., 11 in. Working surface of the table is 26 in. by 6 in. Spindle speeds range from 72 to 1300 r.p.m. Range of table feeds extends from 1¾ in. to 11 in. Size of the overhanging arm is 3-in. diameter by 31 in. long; distance underside of arm to center of spindle, 6½ in.



Light design of knee and column type Producto milling machine.

Tractor Sprocket Wheels

. . . machined on Potter & Johnston automatic with gapped bed.

Production and engineering data related to the application of its model 5-DE automatic to the machining of steel castings for tractor sprocket wheels were recently released by the Potter & Johnston Machine Co., Pawtucket, R. I.

Outside diameter of these steel castings is 33½ in. and, inasmuch as the swing of the 5-DE model is 30 in. over

• Ajax has set up its Upsetters

For Most Accurate Forging and Coining

Outstanding features of Ajax Upsetting Forging Machines have been built into this full line of high speed, heavy duty Forging and Coining Presses.

• ONE-PIECE, SOLID STEEL FRAME, of ample cross section for extremely low stresses and negligible elongation at full rated tonnage, results in close tolerance forgings.

• SOLID SLEEVE CRANKSHAFT BEARINGS in integral frame housings provide rigid support for the full-eccentric crankshaft and prevent deflection of this important member.

• REAR EXTENSION GUIDED SLIDE has the advantages of great guided length and perfect die match at the same time affords full accessibility to the pitman.

• ROLLED STEEL PITMAN, flame-cut from special analysis rolled billet with wrist pin augmented by thrust shoe bearing for outside pitman end.

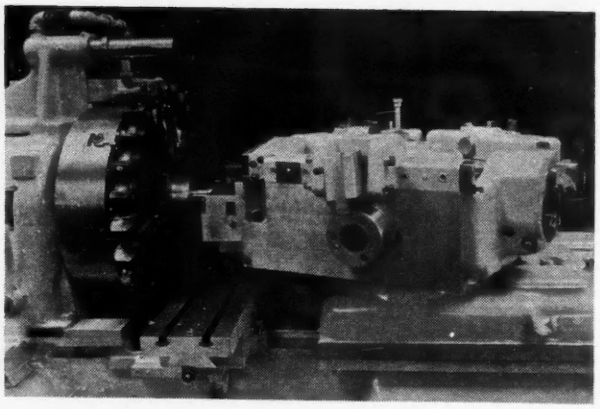
• AJAX PATENTED DIRECT AIR OPERATED FRICTION CLUTCH gives instantaneous treadle response and smooth cushioned starting action at operating speed heretofore regarded as impossible.

IN CAPACITIES FROM 500 TO 2000 TONS

THE AJAX MANUFACTURING COMPANY

EUCLID BRANCH P. O. CLEVELAND

621 MARQUETTE BLDG., CHICAGO • 201 DEWART BLDG., NEW LONDON



Potter & Johnston 5DE automatic set-up for machining tractor sprocket wheels.

the bed, it was found necessary to provide a special gap in the ways between the headstock and cross slide. All machine work was confined to diameters not in excess of 12⅝ in. and, therefore, with the special gap modification, it was possible to supply the size of automatic machine best suited to the diameter of the cutting involved. Another innovation peculiar to this particular job is found in the turret which is of the 5-DE two-spindle design providing faces of larger area than standard to accommodate the style of tooling required.

The tractor sprocket is gripped under the rim for the first holding during which the taper hole, the diameter of the hub, the end of the hub, and the face of the center web are roughed and finished. For the second holding the sprockets are located through an air operated receding bar. Backing is against a hardened steel plate, and the drive is secured from one arm. This second operation allows completion of the machining of the longer hub diameter, the end of the hub, and the other face of the center web.

Machining time for the first operation, 18.93 min.; for the second, 10.73 min. Stellite "J" metal cutting tools are used where advantageous.

Differential

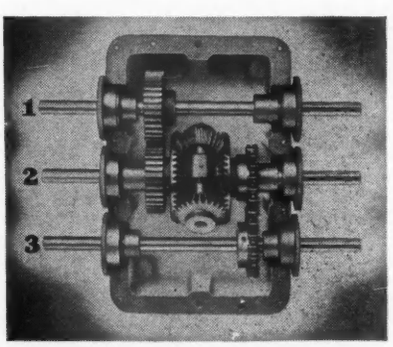
. . . intended for variety of applications in automatic speed control.

Supplementing its line of accessory equipment for use with the Reeves variable speed transmission, Reeves Pulley Co., Columbus, Ind., has developed a new differential.

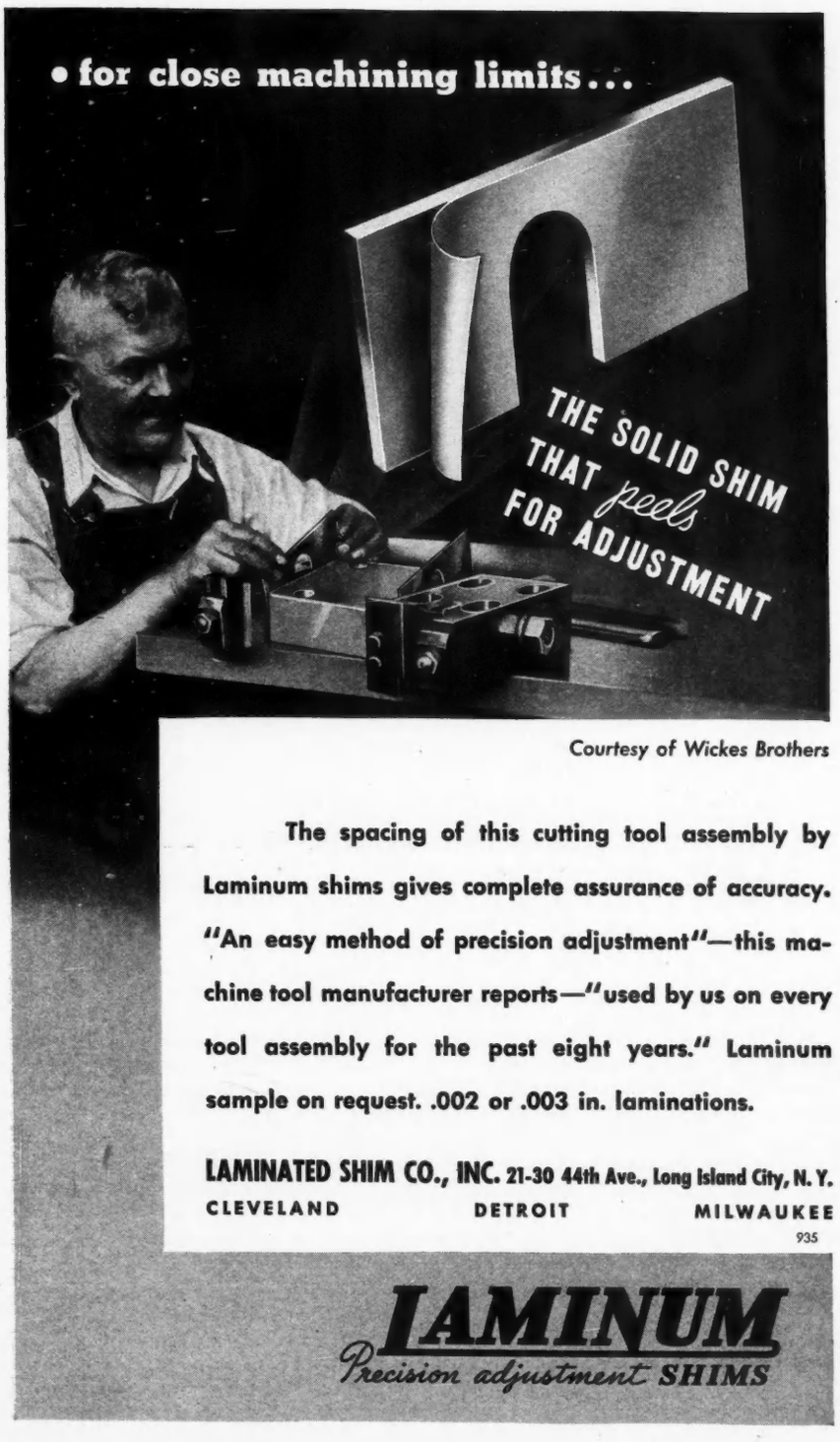
The unit, known as model MDB-3, is intended for a variety of applications in automatic speed control, such as synchronization of two or more machines or parts of a single machine, and maintenance of uniform peripheral winding or unwinding speeds.

Three parallel shafts operating in a bath of oil are mounted in a unit housing. Gears of 1:1 ratio drive between shaft 1 (see illustration) and the differential gearing. Between shaft 3 and the differential gearing is a 1:1 chain drive. (Other ratios are also available.)

For automatic control service, shafts



New Reeves differential for variety of applications in automatic speed control.



Courtesy of Wickes Brothers

The spacing of this cutting tool assembly by Laminum shims gives complete assurance of accuracy. "An easy method of precision adjustment"—this machine tool manufacturer reports—"used by us on every tool assembly for the past eight years." Laminum sample on request. .002 or .003 in. laminations.

LAMINATED SHIM CO., INC. 21-30 44th Ave., Long Island City, N. Y.
CLEVELAND DETROIT MILWAUKEE
935

LAMINUM
Precision adjustment SHIMS

1 and 3 are connected to the driven machine or machines. Shaft 2 is connected to the speed changing screw of the Reeves transmission. When shafts 1 and 3 are driven in the same direction at the same speed, shaft 2 stands still. When the speed of the driven machine varies above or below desired speed, this variation is transmitted to shaft 2 which speeds up or slows down the transmission until synchronous speed is restored.

The differential may also be used as primary driving equipment for loads not exceeding its rated torque and speed capacity. For example, it may be used with other equipment to control index or register, either manually or with photoelectric equipment.

Infinite range of speed variation is possible by connecting shafts 1 and 3 to the constant and variable speed shafts, respectively, of the transmission. By turning the speed control handwheel on the transmission, shaft 2 may be adjusted to any speed in either direction, including zero r.p.m.

Overall dimensions of the unit are 8 in. wide, 11 in. long, and 6⅝ in. high.

Multiple Boring

. . . facing and turning machines of two and three-way types

A new line of multiple boring, facing and turning machines has been brought out by Excello Corp., Detroit. The line comprises both two- and three-way types with from two to nine boring spindles.

In the three-way machine shown in the accompanying illustration it will be noted that the boring spindles with their individual motor drives are separately. mounted on sliding tables. Table feed is by the Ex-Cell-O hydraulic system with individual hydraulic pumps for each table.

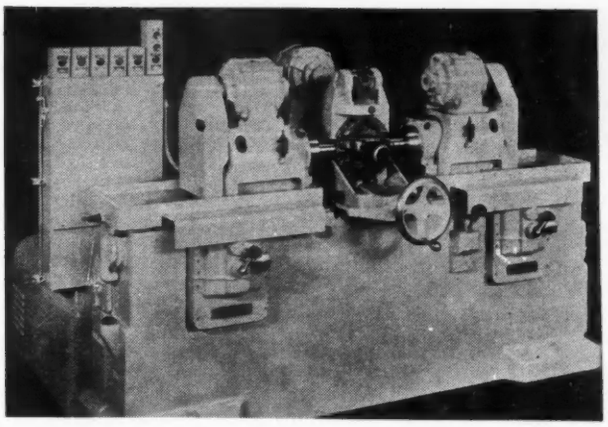
Spindles are standard Ex-Cell-O precision ball bearing spindles mounted in special heads for compactness and so designed that additional spindles may be provided in addition to those shown in the illustration.

Cutting cycles are completely automatic. Each table is provided with micrometer-adjustment dogs for setting the distance for fast approach, cutting, dwell, and fast return. The dwell period at the end of the cutting strokes is separately adjustable from one to 30 sec. A rapid advance between two holes bored by one spindle may also be provided for in the cycle.

Spindle speeds are constant for any particular job, and designed to give a cutting speed of around 400 ft. per min. with carbide cutting tools. Feeds may be varied from nothing to 42 in. per min. If high speed cutting steels are to be used, lower spindle speeds are provided.

Individual starting controls of the push button type are provided on the

(*Turn to page 626, please*)



Three-way Ex-Cell-O multiple boring, facing, and turning machine.

Here's why CAR AND TRUCK MANUFACTURERS ARE ADOPTING

ZENITH FUEL FILTERS

✔ *Zenith Filters* remove all water *as well as rust, dust, dirt and other foreign matter.*

✔ *Zenith Filters are more than 2½ times as fine as ordinary wire screen filters.*

✔ *Zenith Filters have no cartridge or packing to replace, no screen to be damaged.*

LITTLE wonder that Buick and Cadillac—International, White and GMC trucks—originally equip their vehicles with Zenith Fuel Filters. For only Zenith Filters, with their new type elements, completely remedy the defects of screen filtration. Tests—and experience—have proved Zenith Filters are 2½ times more efficient.

Zenith Fuel Filters take out all water, dirt, dust and rust before they reach the carburetor. The water is separated from gasoline *mechanically* . . . not by gravity.

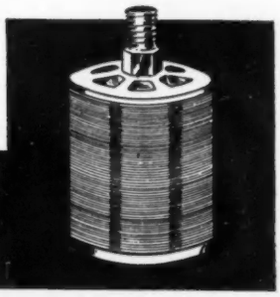
Zenith Fuel Filters are made in types to fit almost every mechanical fuel pump. They are inexpensive and easily cleaned. No cartridges or packing to replace. For information and prices—request our representative to call.

The assembly of brass discs and spacers through which gasoline is filtered in a Zenith Fuel Filter. Openings are .002 of an inch, several times as fine as ordinary 100 mesh wire gauze.

ZENITH CARBURETOR COMPANY

(*Subsidiary of Bendix Aviation Corporation*)

699 Hart Avenue Detroit, Michigan



ORDINARY FILTERS *don't remove water*

Prices Announced

(Continued from page 533)

models, the right hand tail lamp. The group has been sold at an extra charge heretofore, involving about $13. The new prices, therefore, nominally showing increases of $26 to $34, are comparatively higher by $13 to $21. The increases were made because of the steady advance in manufacturing costs.

Following are the new price schedules made available:

Chevrolet

Master	1938 Prices	1937 Prices*
Sedan, 4d.	$730	$698
Coach, 2d.	668	637
Town sedan, 2d.	688	655
Sport sedan, 4d.	750	716
Business coupe	648	019
Cabriolet	755	725
Master DeLuxe		
Sedan, 4d.	796	770
Coach, 2d.	730	702
Town sedan, 2d.	750	721
Sport sedan, 4d.	817	788
Business coupe	714	685
Sport coupe	750	724

* Did not include $13 to $14 of equipment now included in Flint delivered price.

Plymouth

Six—P5		
Coupe	645	580
Sedan, 2d.	685	620
Sedan, 4d.	730	665
DeLuxe Six—P6		
Coupe	745	650
Coupe, rumble seat	785	700
Conv. coupe	865	830
Sedan, 2d.	788	715
Touring sedan, 2d.	800	725
Sedan, 4d.	818	745
Touring sedan, 4d.	830	755
Sedan, 7-pass.	1020	995
Limousine	1110	1095

Oldsmobile

Secured from Dealers

Six	1938 Prices	1937 Prices
Business coupe	$870	$810
Club coupe	926	870
Sedan, 2d.	916	870
Touring sedan, 2d.	941	895
Sedan, 4d.	967	920
Touring sedan, 4d.	992	945
Conv. coupe	1043	965
Eight		
Business coupe	986	925
Club coupe	1032	985
Sedan, 2d.	1027	985
Touring sedan, 2d.	1053	1010
Sedan, 4d.	1078	1035
Touring sedan, 4d.	1104	1060
Conv. coupe	1160	1080

Hudson, Hudson Terraplane

Hudson Terraplane	1938 Prices
Brougham	$840
Touring brougham	860
Sedan	881
Touring sedan	901
Victoria coupe	852
Coupe, 3p.	806
Convertible coupe	943
Conv. brougham	1007
Hudson Super-Terraplane	
Brougham	913
Touring brougham	934
Sedan	950
Touring sedan	970
Victoria coupe	921
Coupe, 3p.	880
Convertible coupe	1006
Conv. brougham	1069
Business Hudson Terraplane	
Utility coach	840
Tour. utility coach	860
Utility coupe	803
Hudson Six	
Brougham	983
Tour. brougham	1003
Sedan	1020
Tour. sedan	1040
Victoria coupe	990
Coupe, 3p.	944
Convertible coupe	1076
Conv. brougham	1139
Hudson Eight	
Brougham	1064
Touring brougham	1084
Sedan	1095
Touring sedan	1115
Victoria cope	1066
Coupe, 3p.	1025
Convertible coupe	1156
Conv. brougham	1220
Hudson Eight-Custom	
Brougham	1144
Touring brougham	1165
Sedan	1181
Touring sedan	1201
Victoria coupe	1141
Coupe, 3p.	1090
Hudson Country Club	
Sedan	1209
Touring sedan	1229

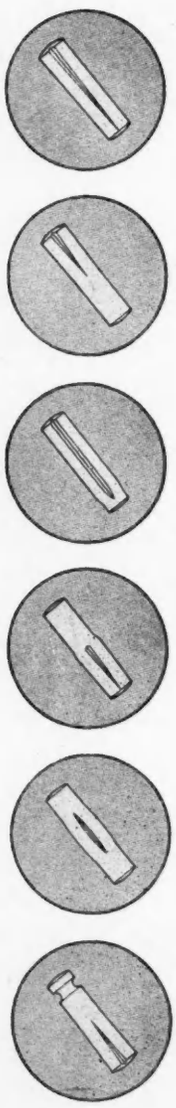
Lincoln-Zephyr

Factory delivered prices including all standard equipment but no federal or state taxes nor transportation charges.

	1938 Prices	1937 Prices
Coupe	$1295	$1165
Sedan, 2d.	1355	1245
Sedan, 4d.	1375	1265
Limousine	1550	1425
Conv. Coupe	1650	....
Conv. sedan	1790	....

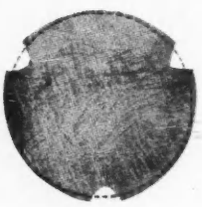
(Turn to page 628, please)

CUT YOUR ASSEMBLY COSTS TO THEIR LOWEST LIMITS



Join other leading manufacturers in enjoying the substantial savings effected by Groov-Pins. They cut assembly costs to the lowest limits by replacing conventional standard and taper pins as well as various types of screw and locknut assemblies.

More than a billion Groov-Pins have been used by leading manufacturing industries the world over in the assembly of their products. Groov-Pins come in a number of different shapes and sizes for various applications.



The Groov-Pin is a cylindrical pin with pressed longitudinal grooves which deform the periphery. These bulges are forced back into the grooves when pressed into a plain-drilled hole, forming an extremely tight fit against the hole wall.

Groov-Pins are convenient and economical as demonstrated by time studies. It eliminates costly tapping and reaming operations, reduces steps in assemblies, enters heretofore inaccessible places. Due to its resiliency, it provides a greater factor of safety.

Send today for your copy of the Groov-Pin Bulletin. Examine the engineering data and complete information it contains. Look into Groov-Pin's advantages—see how it saves time and money in assuring a better grip.

GROOV-PIN CORPORATION
411-13 Kerrigan Avenue UNION CITY, N. J.

Production Lines on Higher Levels

(Continued from page 575)

for this purpose is made by National Broach, Inco, Ex-Cell-O, and Fellows.

One of the most recent developments, and one which has revolutionized the design of fastenings to a large extent is the taper spline produced on Barber-Colman hobbers, used for axle ends, crankshaft ends, etc.

Precision boring has grown to big dimensions what with the current adoption of cylinder boring with the single-point tool. Leading exponents of this practice are Heald and Ex-Cell-O.

Closely associated with cylinder boring is the familiar and most essential cylinder honing technique. Many important improvements have been made in this field recently both by Hutto and Micromatic.

Hypoid gears have pretty well swept the industry with but few outstanding exceptions. And this has created a new field of activity for the Gleason Formate cutter which has the happy facility of cutting both hypoid and the more or less conventional, though modified, spiral bevel gears.

There is little we can add to the prestige enjoyed by the hard cutting materials which have found their economic level in important metal cutting operations. The cemented-carbides have grown by evolution to the point where it is possible to get a special type of material for any given set of conditions. Primary producers in this field are Carboloy, Ramet, Firth-Stirling, and others. In this category, too, is the well-known Haynes J-metal, so widely used for milling cotters and other metal removing tools where the high-speed-steel tools no longer satisfy the need for high speed and heavy cuts.

Huge presses for turret top stampings, new forging hammers, and the big die casting machines developed with the advent of the zinc alloy radiator grilles, all help to round out the picture of modernity.

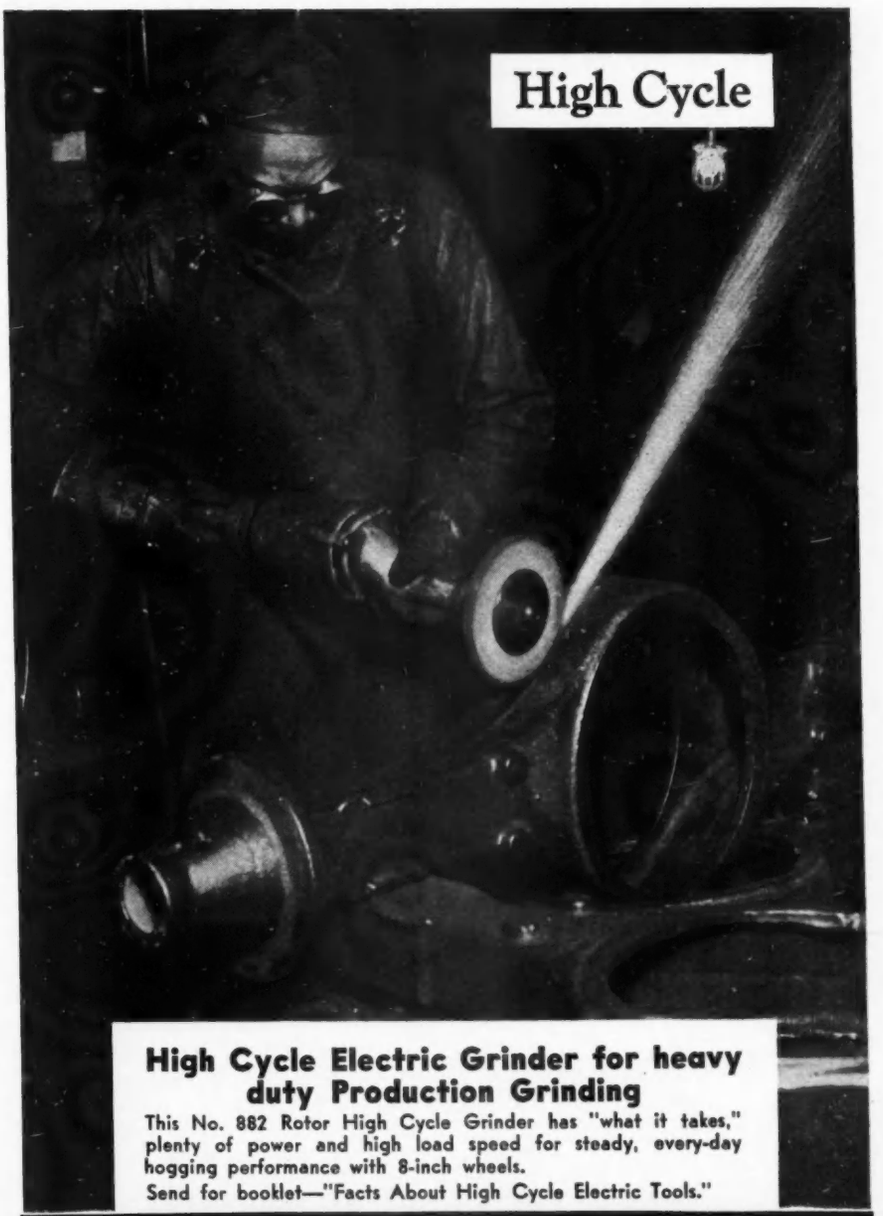
Heat treating has undergone vast improvement in recent years due to improvement in techniques and equipment. The list of familiar suppliers is much too long to mention here but we might note in passing the new-furnaces made by the Electric Furnace Co., Hevi-Duty, Holcroft, and others. The Holcroft furnace is particularly interesting by virtue of the new installations at Buick where transmission gears are hardened by a gas-carburizing atmosphere and quenched automatically without ever leaving the protective, scale-free atmosphere.

Not far afield in heat treating is the new Tocco induction-hardening process which has proved so successful in the surface hardening of crankshafts and has been adopted on at least one 1938 car for the hardening of camshafts.

Finally, we might mention that by the time this article is off the press, Cadillac will have in operation a new and most interesting production line for the manufacture of the new 185-hp., V-16 engine. While on the subject of Cadillac, it is of interest to note that one single small-package transmission will be used for the entire 1938 line, from the LaSalle through the V-16. This is probably the best commentary on the type of thinking production-wise that makes possible such high quality at unbelievably lower cost.

Time and space do not permit a detailed discussion of the other types of machines such as Bullard, Natco, Ingersoll, Greenlee, and all the rest that have done so much to place automotive production on a higher plane of quality, productivity and economy.

Suffice it to say, that the place of the machine tool industry is firmly grounded and thoroughly appreciated by the factory man.



High Cycle Electric Grinder for heavy duty Production Grinding

This No. 882 Rotor High Cycle Grinder has "what it takes," plenty of power and high load speed for steady, every-day hogging performance with 8-inch wheels.

Send for booklet—"Facts About High Cycle Electric Tools."

THE ROTOR AIR TOOL COMPANY
CLEVELAND, OHIO

TOOLS OF TOMORROW

(*Continued from page 623*)

control panel shown for the electric motors operating the spindles and pumps, with two additional buttons permitting simultaneous starting and stopping of all motors.

Each table is provided with a separate lever control to permit individual operation, or all three tables may be started and stopped with a single lever shown to the right of the hand-wheel in the illustrated machine. Controls are adjustable so that carriers may be fed in simultaneously or in rotation.

The machine illustrated here is equipped for dry cutting. A sump is provided in the base of the equipment, however, to permit installation of a coolant system. When the cutter is used, the coolant pump is driven by one of the hydraulic control pump units.

Chips drop down through the top of the machine and are ejected out the back of the machine through slides adjacent to the center unit.

Parts are clamped in stationary fixtures, those shown here being of the manual type, although both hydraulic or air operated fixtures may be used, synchronized with the cutting cycle.

The T-shaped base in the three-way type is cast in one piece of nickel chrome alloy iron and is aged in addition to being normalized. The base is liberally webbed for maximum rigidity. Force feed lubrication is provided for the table ways. One of the table ways is flat; the other is V-shaped.

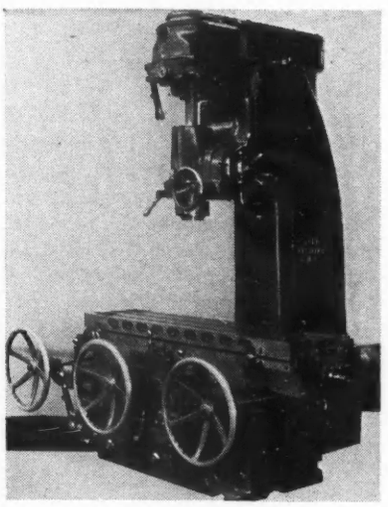
Spindles are universally adjustable: vertically, axially as well as transversely. Holes from ⅝ in. up to six inches in diameter may be bored. Maximum table travel is 12 in. A fixture pad of 15 in. by 15 in. provides ample support for large fixtures to handle large parts. Return speed and rapid approach is 11 ft. per min.

Vertical Miller

. . . and die sinker equipped with helical gear drive to spindle

A new model vertical miller and die sinker equipped with helical gear drive to spindle has been brought out by the Reed-Prentice Corp., Worcester, Mass. The entire top gear box of this No. 5 machine is equipped with helical gears mounted on Timken bearings, replacing the belt drive construction previously used.

Some of the essential specifications of the machine are: longitudinal power feed, 48 in.; cross power feed, 16 in.; vertical adjustment of head on the column, 15 in.; vertical feed of the spindle, 9 in.; maximum distance of end of spindle to table, 30 in.; throat depth, 20 in.

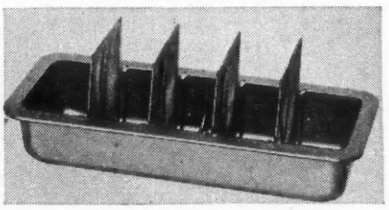


Reed-Prentice vertical miller and die sinker.

There are 18 spindle speeds; the standard range from 17 to 600 r.p.m. The high speed range from 34 to 1200 r.p.m. Eight spindle feeds range for the 18 speeds from 0.002 to 0.297 in.

Working surface of the table is 68 in. by 16 in.; rapid power traverse in either longitudinal or cross direction, 100 in.

AN END TO FILTER REPLACEMENTS



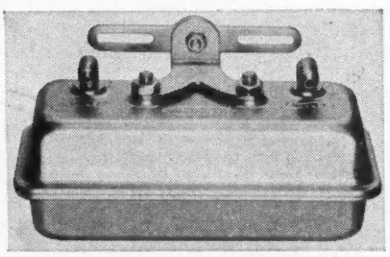
Sectional View Showing Traps also Diversified Filtration
Aluminum Die casting—Baked enamel finish

One Model to Fit All Cars and Trucks

With the Permanent Oilfilt'eer installed there are no replacements of cartridges, refills or filters to buy. By simply removing three bolts, at bottom of case, cleaning and re-assembling in a few minutes.

We will gladly furnish complete information upon hearing from interested parties. Write for Literature, Prices, today.

PERMANENT OILFILT'EER
4155 W. Cullerton St., Chicago, Ill.



Complete Assembly

PERMANENT OILFILT'EER

Calendar of Coming Events

SHOW BUSINESS

Manager of the National Automobile Show in New York is Alfred Reeves, 366 Madison Ave., N. Y. C. Inquiries concerning all matters connected with the national show should be addressed to him. AUTOMOTIVE INDUSTRIES will be pleased to furnish names and addresses of local show managers on request.

DOMESTIC SHOWS

New York, National Automobile Show, Oct. 27-Nov. 3
Toledo, O., Automobile Show. Oct. 27-Nov. 3
Boston, Mass., Automobile Show, Oct. 30-Nov. 6
Washington, D. C., Automobile Show, Oct. 30-Nov. 6
Los Angeles, Cal., Automobile Show, Oct. 30-Nov. 7
San Francisco, Automobile Show, Oct. 30-Nov. 6
Cincinnati Automobile Show. Oct. 31-Nov. 6
Altoona, Pa., Automobile Show....Nov. 2-6
Akron Automobile Show.....Nov. 6-12
Brooklyn Automobile Show.....Nov. 6-13
Chicago Automobile Show.....Nov. 6-13
Columbus Automobile Show.....Nov. 6-12
Omaha Automobile Show.....Nov. 6-11
Detroit Automobile Show.....Nov. 6-13
Motor Truck Show, 4th Annual, Newark, N. J.....Nov. 6-12
Newark, N. J., Truck Show.....Nov. 6-12
Buffalo, N. Y., Automobile Show..Nov. 6-13
Indianapolis, Automobile Show..Nov. 11-20
Newark, N. J., Automobile Show..Nov. 6-13
Philadelphia Automobile Show....Nov. 6-13
Pittsburgh, Pa., Automobile Show. Nov. 6-13
Jersey City, N. J., Automobile Show, Nov. 8-13
Baltimore, Md., Automobile Show, Nov. 13-20
Cleveland, Ohio, Automobile Show, Nov. 13-20
Rochester, Automobile Show.....Nov. 13-20
Springfield, Mass., Automobile Show, Nov. 14-20
St. Louis, Mo., Automobile Show. Nov. 14-21
Portland, Ore., Automobile Show. Nov. 14-21
Denver, Colo., Automobile Show, Nov. 15-20
Milwaukee, Wis., Automobile Show, Nov. 17-24
Kansas City, Mo., Automobile Show, Nov. 27-Dec. 4
A.S.I. Show, Navy Pier, Chicago, Dec. 6-Dec. 11

FOREIGN SHOWS

Czechoslovakian Automobile Show, Prague .....Oct. 16-24
Italy, 10th International Automobile Salon, Milan .....Oct. 28-Nov. 8
Great Britain, 13th International Commercial Automobile Exposition (trucks and buses), London...Nov. 4-13
Toronto, Ont., Automobile Show..Nov. 6-13
Great Britain, 36th Scottish International Automobile Exposition, Glasgow .....Nov. 12-20
Montreal, Que., Automobile Show, Nov. 20-27
Peru, Automobile Show, Lima, Dec. 23-Jan. 6, 1938

CONVENTIONS AND MEETINGS

National Machine Tool Builders Asso., Annual Meeting, Hot Springs, Va., Oct. 25-27
SAE Annual Dinner, Commodore Hotel, New York .....Oct. 28
American Foundrymen's Association, 2nd annual foundry conference, Iowa City .....Oct. 29-30
American Petroleum Institute, 18th Annual Meeting, Stevens Hotel, Chicago .....Nov. 8-12
SAE Regional Transportation and Maintenance Meeting, Newark, N. J. .....Nov. 9-10
International Acetylene Association, Annual Convention, Birmingham, Ala. .....Nov. 10-12
American Society of Mechanical Engineers, New York .....Dec. 6-10
SAE National Production Meeting, Flint, Mich. .....Dec. 8-10
SAE Annual Meeting, Detroit, Jan. 10-14, 1938
American Road Builders' Association, Cleveland .....Jan. 17-21, 1938

Gasoline Use Rises

Daily average gasoline consumption for the first seven months of this year was up 10.67 per cent over the 1936 figure, according to the American Petroleum Institute bulletin. For the month of July alone the gain was 7.20 per cent. Total gasoline consumption, as nearly as it can be secured, was placed at 11,947,598,000 gals. for the seven months, against 10,847,037,000 for the like period in 1936.

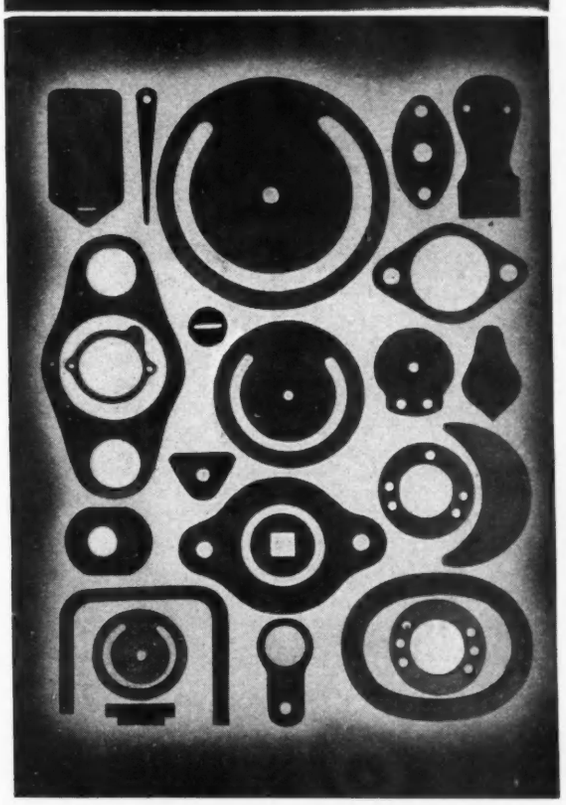
Blaw-Knox Buys Unit

The Blaw-Knox Co. disclosed in a listing application to the New York stock Exchange that it has acquired the assets, business and goodwill of R. M. Gordon & Co., makers of devices for the automatic pressure lubrication of machinery.

K-L BRAND LEATHER & WASHERS

Hydraulic Packings and MECHANICAL LEATHERS

NOTHING TAKES THE PLACE OF Leather



"V" Leather

Cup Leather

"U" Leather

Flange Leather

Send Us Specifications or Samples for Prices!

EXCELSIOR LEATHER WASHER MFG. CO.
ROCKFORD, ILLINOIS

Prices Announced

(Continued from page 624)

Hupmobile

Six	1938 Prices	1937 Prices
Regular sedan	$1180	....
De Luxe sedan	1222	....
Custom sedan	1340	....
Eight		
Touring sedan	$1325	....
DeLuxe touring sedan	1365	....
Custom touring sedan	1485	....

De Soto

Business coupe	$870	$770
Convertible coupe	1045	975
Tour. brougham, 2d.	930	840
Sedan, 4d.	958	870
Tour. sedan, 4d.	970	880

De Soto—Cont.

	1938 Prices	1937 Prices
Conv. sedan	1375	1300
Sedan, 7p., 136 in. w.b.	1195	1120
Lim. sedan, 136 in. w.b.	1285	1220

Nash

Nash-Lafayette Master		
Business coupe	$770	....
Sedan, 2d.	805	....
Sedan, 4d.	850	....
DeLuxe		
Cabriolet	940	....
All purpose coupe	860	....
Victoria sedan	855	....
Business coupe	820	....
Sedan, 4d.	900	....
Nash-Ambassador Six		
Cabriolet	1090	$1040
All purpose coupe	1015	990
Victoria sedan	1000	975
Business coupe	970	935
Sedan, 4d	1050	1025

Nash-Ambassador Six—Cont.

Eight	1938 Prices	1937 Prices
Cabriolet	1240	1180
All purpose coupe	1165	1130
Victoria sedan	1150	1115
Business coupe	1120	1075
Sedan, 4d.	1200	1165

Talk of Hoffman

(Continued from page 533)

reproduced herewith was taken from the Springfield (Mass.) *Daily News* of Saturday, Oct. 2.

Who's News Today

By LEMUEL F. PARTON

New York, Oct. 2—Dr Tsune Yu, Chinese consul general in New York; a leading speaker at tonight's Ma[illegible] Square Garden meeting [illegible] against Japan[illegible] [illegible] more [illegible] old, [illegible] with the new spirit of Chinese statehood and unity.

An astute friend of this writer, returning from Detroit, where he plumbed the general drifts of industry and politics, said he heard a great deal of talk about the possibility of Paul J. Hoffman as a Republican candidate for the presidency. Mr Hoffman is president of the Studebaker Corp., acclaimed in the business community for the speed and skill with which he swung that business into the black, after its receivership. Lots of people out there think he could do the same thing for the U. S. A., my informant explained.

He commented further on a new awareness and determination in big business in Detroit and Chicago.

"Detroit is worried over the C. I. O.," he said, "and the possible flight of business to other cities. I encountered skepticism about the discovery of any Messiah in the Republican political ranks and heard much talk about business getting up on its hind legs and putting somebody over on its own account. Mr Hoffman was very much in this picture."

Mr Hoffman, handsome, forceful and engaging, began his business career as a Studebaker automobile salesman in Los Angeles, after two years in the University of Chicago. He has held leadership in national automobile safety campaigns and drives for scientific traffic regulation, having been active in the establishment of the Harvard school of traffic study.

The London Morning Post suspends after 165 years of continuous publi[illegible]

UAW Warns Chrysler

Chrysler Corp. was warned by the United Automobile Workers, Oct. 20, that the union is preparing to file charges with the regional office of the NLRB of violation of the Wagner Act. The letter was addressed to W. P. Chrysler in New York. The complaint concerns discrimination against the UAW.

Better Metal Cleaning at Lower Costs ★ ★ ★

Eliminate Rejects with Perfect Cleaning.

Speed Up Your Production Cleaning.

Eliminate Excessive Labor and Waste.

The Blakeslee Solvent Degreasing process renders the metal parts clean and dry in one operation. No scrubbing or soaking. Oils, greases, drawing compounds and polishing compounds thoroughly and quickly removed. All spot welds, cracks, and seams cleaned 100%.

There are small hand operated degreasers as well as the large fully and semi automatic models. No matter how large or how small your job there is a Blakeslee Dual-Vapor-Control degreaser to fit your cleaning requirements.

A 30 day free trial is offered you on any one of our standard model degreasers. The transportation charges and the solvent used during the test are the only obligations.

Literature mailed upon request

G.S.BLAKESLEE & CO.

EASTERN SALES OFFICE
381 4TH AVENUE
NEW YORK, N. Y.

MAIN OFFICE & WORKS
CICERO STATION
CHICAGO, ILL.